

Chemical Week

September 29, 1951

Price 35 cents



OPS seeks to scuttle Capenart amendment; industry lies low, awaits tailored price laws . . . p. 9

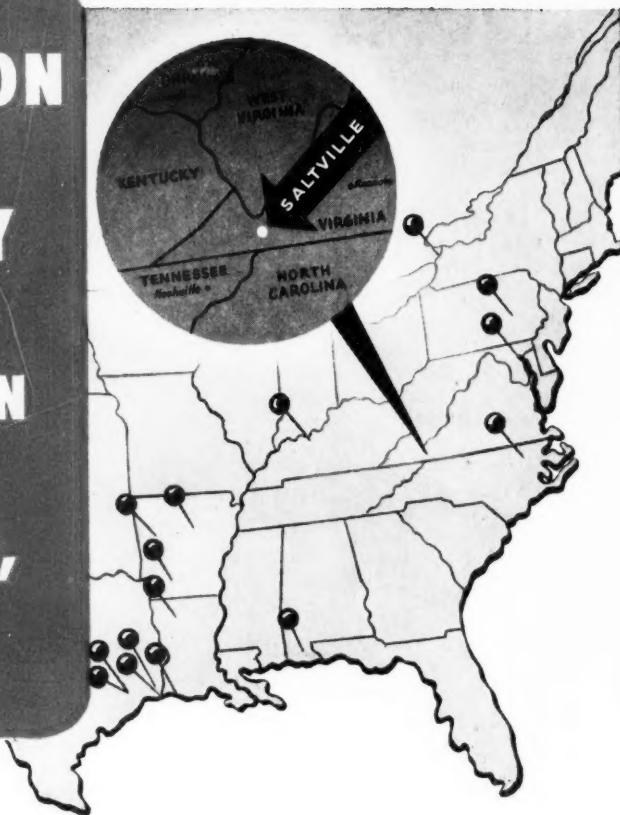
► **CW Report: Ethylene to spearhead advance as petrochemicals begin decade of fourfold expansion . . . p. 19**

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► **SRI's Vagtborg leads mission to Europe, surveys Germany's needs for applied research institutes p. 39**

Firm isopropyl alcohol demand freezes complex price setup . . . p. 45

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SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

Chemical Week

Volume 69 Number 13
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DELTA CHEMICAL WORKS

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OPINION

Sperm vs Lard

TO THE EDITOR: In one of your issues there appears an article about cutting oils (Slicker, Cooler Cutting) . . . and the products used in the manufacture of such compounds.

For a number of years we have been supplying sperm whale oil to manufacturers of cutting oils. . . . It has been found to have advantages over lard oil for this application.

In the article you state that for severe conditions a mineral-lard blend is used, but lard oil is objectionable in that it oxidizes, gumming up the machine, and easily turn rancid, causing foul odors and promoting growth of dermatitis-causing bacteria. Sperm oil does not have the disadvantage of becoming gummy or rancid . . . does not oxidize to the extent that lard oil oxidizes.

We thought the writer of this article would be interested and want these points called to his attention.

JOHN D. HETCHLER
Chemical Director
Archer-Daniels-Midland Co.
Cleveland, Ohio

Who's Kidding Whom?

TO THE EDITOR: In your September 8th Opinion department Reader Harry A. Curtis of Knoxville, Tenn. intended to prove that 8=9. To do this he first showed that 2=1. In doing so, he said,

"Any two numbers, say a and b, one of which appears to be larger than the other, can be shown to be equal. Thus let a be the larger and b the smaller number, the difference being c. Then,

$$\begin{aligned}
 a &= b + c \\
 (a - b)a &= (a - b)(b + c) \\
 a^2 - ab &= ab + ac - bc \\
 a^2 - ab - ac &= ab - b^2 - bc \\
 a^2 - ab - ac &= ab - b^2 - bc \\
 a - b - c &= a - b - c
 \end{aligned}$$

giving,

$$\begin{aligned}
 a &= b \\
 2 &= 1. "
 \end{aligned}$$

Going back to his equation,

a = b + c

then, a - b = c

and also, a - b - c = 0

In his division by this a-b-c, he divided by zero, and the results of any division by zero is always not defined, unless there are limitations put upon the division.

In his second set of equations he has,

$$5 + \frac{9x - 60}{8 - x} - \frac{4x - 20}{9 - x} = 0$$

reducing this,

$$\frac{4x - 20}{8 - x} = \frac{4x - 20}{9 - x}$$

This much is correct, but he then assumes from this that 8=9. I would like to point out that no value for x will prove 8=9. Also since the only solution here for x is 5, then,

$$\begin{aligned}
 (4)(5) - 20 &= (4)(5) - 20 \\
 8 - 5 &= 9 - 5 \\
 20 - 20 &= 20 - 20 \\
 3 &= 1 \\
 0 &= 0 \\
 - &= - \\
 3 &= 4 \\
 0 &= 0 \\
 - &= - = 0 \\
 3 &= 4 \\
 (4)(0) - (3)(0) &= 0 \\
 12 &= 12 \\
 0 &= 0
 \end{aligned}$$

and not 8 = 9.

Were you kidding, Mr. Curtis?

ROBERT W. KISER,
Rock Island, Ill.

This deft algebraic footwork has us stumbling, unsure as to whether two does equal one. But this we know: one 1939 dollar is equal to two 1951 dollartettes.—Ed.

Poison Peddlers

TO THE EDITOR: . . . You have maintained a stout defense for the chemical industry re the matter of chemicals in foods. And I agree with the various reports you have carried on the machinations of the Delaney Committee investigations . . .

But it seems to me that the truth is being distorted elsewhere . . . that the public is being led to believe that all chemicals are evil . . . that chemical manufacturers are irresponsible. I cite as an example a column from a recent issue of The Grand Rapids Press (Sept. 10) written by Louis Bromfield who, as you know, gained his reputation as a gentleman farmer and novelist . . .

T. M. HALL,
Grand Rapids, Mich.

Some quotes on which chemical makers might well ponder—and appraise as to their seriousness—follow.—Ed.

"Most of what the American people eat is . . . sprayed, dusted or drenched with poisons. If this does not directly happen to the food we eat . . . it is processed in an atmosphere which

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O P I N I O N

is . . . a fog of poison . . . such as
soap-replacing detergent . . .

"Many of the poisons are not merely
old fashioned arsenic which we know
as lethal . . . many are strange and
new . . . are the products of the new
super-chemistry which turns out new
and violently lethal products almost
weekly. These are rushed into use
. . . sprayed and dusted over virtually
everything . . . we eat before anything
whatever is known concerning their
effect on our health . . ."

" . . . Often . . . this indiscriminate
use is actually recommended by . . .
the Dept. of Agriculture."

"A Commission has been formed
. . . to protect us . . . from a menace
suffered by no other people in the
world . . . The Committee investiga-
tions have given rise to one of the
most extraordinary smear campaigns
in our history. Mr. Delaney (Chair-
man of the Committee) has been
blackguarded . . . those who testified
that we know nothing of . . . strange
new chemicals have been called liars,
fools, . . . virtually threatened with
blackmail . . ."

"The campaign is traceable to ex-
actly one source—the giant chemical
manufacturers who make millions
each year out of the tons of poison
used . . . in the growing and process-
ing of American food. Whether the
responsible executives are aware of
the facts or not, I do not know but
I suggest that they inform themselves."

"The campaign comes directly from
the hucksters and hirelings of the
companies who are paid to sell the
products, influence public and
congressional opinion and edit the chemi-
cal trade papers."

"Most of these men are neither
chemical nor medical authorities . . .
their efforts have reached . . . college
teachers who should be incorruptible
. . . It doesn't matter what happens
to the stomachs, hearts and health
of the American people as long as we
sell our poisons."

" . . . the chemical companies . . .
are doing their best to cripple or sup-
press the inquiries of the Delaney
Committee. It is just possible you
would be protecting yourself and your
children by writing your congress-
man . . . urging him to support the
action and hearing of the Delaney
Committee. . . ."

CW welcomes expressions of opinion
from readers. The only requirements:
that they be pertinent, as brief as
possible.

Address all correspondence to: The
Editor, Chemical Week, 330 W. 42nd
St., New York 18, N. Y.

U.S.I. CHEMICAL NEWS

September 29

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries

★ 1951

Intravenous Alcohol Good General Pain-Killer

Favorable results have been reported in 2000 cases where alcohol-water solutions were injected intravenously to relieve pain. Doctors state that patients have no "doped" feeling, but rather a sense of well being.

The physicians anticipate that it may be possible to eliminate entirely the use of opiates and other sedatives in post-surgical cases by steady injection of an alcohol-water solution over a 24-hour period. Unlike opiates, alcohol does not lower respiratory activity. Also, again as distinct from opiates, it tends to dilate blood vessels rather than constrict them; so that injecting patients with heart trouble is recommended by the doctors as an aid in the use of anesthetics.

An added advantage of the alcohol therapy, especially in cases where patients have been weakened by their illness, is that alcohol has a nutritional value because it is quickly converted into energy by the body.

New Theory: Reduction, Not Oxidation, Causes Paint Deterioration

A reducing action, rather than oxidation, may be the cause of paint deterioration, according to a new chemical theory. Evolved in work on auto finishes, the new theory may also apply to house paints and other protective coatings.

It was thought in the past that the dull film or "chalk" that sometimes develops on auto finishes was caused by combination of the lacquer or enamel materials with oxygen of the air. In tests, lacquer and enamel films were subjected to hydrogen peroxide to see if it would hasten the process, but the attempts failed. Realizing that under certain conditions hydrogen peroxide may act as a reducing agent, the researchers set up these conditions by smearing water or a wetting agent on the test panels, whereupon "chalk" formed in a matter of minutes.

Develop More New Uses For Polyvinyl Pyrrolidone

A new polyvinyl pyrrolidone product, to be used by dyers for removing color from textiles and said to have no harmful effects, has been placed on the market, a German company reveals. Another new polyvinyl pyrrolidone product for use as a laundry cleaning agent is reported in the experimental stage. Other experiments are in progress for improving medicinal and other products made with polyvinyl pyrrolidone.

New Booklet Reviews Fertilizer Technology

Special articles reviewing the activities of the Tennessee Valley Authority in fertilizer technology are featured in a recent issue of a government bibliography of technical reports. Chemical plant facilities are described and research work with phosphates, nitrates, and potash is covered. Also listed are currently available chemical engineering reports on the subject.

Southern Dealers to Show New U.S.I. Sound Movie On Pyrenone Grain Protectant

Insect Infestation Problem in Stored Grain Is Dramatized To Farmers by Cartoon Character 'Wicked Willie Weevil'

A 16 mm sound movie film that will run about 15 minutes is being readied for showing by Pyrenone Grain Protectant dealers throughout the South.

The film features a cartoon character called "Wicked Willie Weevil."

Wicked Willie Weevil tells the story of insect damage to stored grain and how Pyrenone Grain Protectant stops it. The film uses this cartoon character to dramatize to farmers

Bond Silicone Rubber To Steel, Other Surfaces

A method of joining silicone rubber to steel and other surfaces in a permanent bond stronger than rubber itself, has reportedly been discovered. Key to the process is said to be a thin, glue-like "primer," which forms a strong bond between silicone rubber and many surfaces besides steel, including glass, ceramics, aluminum, tin, and copper. Development of the primer is expected to increase the usefulness of silicone rubber in structural combination with metals.

To produce the bond, the liquid primer is brushed or sprayed on the metal or glass surface to be joined to silicone rubber. After drying, the surfaces are placed together and light pressure is applied at about 250°F. The resulting bond is claimed to withstand temperatures from -85°F. to 500°F. In laboratory experiments, the bond has shown a strength of about 700 pounds per square inch of holding area.

Possible applications include engine and shock mounts and heavy-duty washers or gaskets, for industrial applications, made of glass fiber bonded between layers of silicone rubber.

New Chemical Skin For Wrapping Foods Is Edible

A new edible skin for wrapping food products, said to seal in odor and flavor, to keep out moisture, and to be comparatively resistant to bacteria and mold, has been developed. Chemically the new skins are known as acetostearins and are prepared by direct acetylation of monostearin with acetic anhydride. These acetostearins, claimed to be relatively stable, solidify to a flexible but non-greasy solid. Over half of the acetostearins prepared by the chemist responsible for the development stretched over 800% at 22°C., and no cracking was observed at temperatures as low as 4°C., according to his report. The acetostearins are said to be as easy to apply as paraffin.

Germans Synthesize Carotin

A process for making synthetic carotin for use in vitaminizing and coloring margarine has been developed by a German scientist. Work is now underway to adapt the laboratory synthesis to commercial production.



Most southern corn cribs are of open construction. Insects have little difficulty stealing corn from farmers when it's so easy to enter the crib.

the seriousness of the insect problem to stored grain in the South. The film will be shown

MORE

Colloid Chemicals Prevent Kidney Stone Formation

A new method of preventing formation of kidney stones is being based on the theory that growth of these crystal deposits in the kidneys is prevented in normal persons by the presence in the urine of certain types of colloid. Research indicates that the stones are most prevalent in people lacking these colloids. Various types of colloid will gel at certain concentrations and prevent mineral matter in the urine from crystallizing. Results obtained thus far from injecting colloidal agents into the body are described as very encouraging.

Synthesize Plant Sugar Outside of Plant Cell

For the first time plant sugar has been produced outside of a plant cell according to a recent report by a university scientist. When a test tube containing a mixture of water, carbon dioxide, and various substances taken from hog and pigeon livers and from plant leaves, was exposed to light, the mixture was transformed into plant sugar, it is claimed.

September 29 ★

U.S.I. CHEMICAL NEWS

★ 1951

CONTINUED

New U.S.I. Sound Movie

at a series of dealer-farmer meetings to be held in southern towns before harvest season. While the film will be the main feature of the meeting, it is anticipated that individual dealers will arrange for local entertainment and serve refreshments to insure good attendance.

The new movie tells the story of Pyrenone Grain Protectant quickly and effectively. The



Insect infested corn has lost so much of its food value that it is practically worthless for live-stock feeding.

mass showings that the film makes possible will enable U.S.I. to introduce its new Pyrenone Grain Protectant to a large number of people in a short time.

Requests Pour in for 'Quart Jar Test' Kits

Another item that has been creating a tremendous amount of interest among southern farmers and dealers is the "Quart Jar Test" kit. This kit contains a sample of Pyrenone Grain Protectant and other necessary pieces to set up a small-scale test. To make the test, the farmer shells corn from his crib into two one-quart mason jars. He treats the corn in one of the jars with Pyrenone Grain Protectant and leaves the other untreated. Within 30 to 60 days the farmer can see clean corn, with a few dead insects visible, in the treated jar, while the untreated one swarms with live weevils.

Requests for the Quart Jar Test kits have been pouring in to U.S.I. and are positive evidence of the urgent need for a product that will control stored grain pests.

New Condensation Method Produces Vinyl Polymers

A new condensation procedure, now in the laboratory stage, reportedly has possibilities for use in producing vinyl polymers. In the laboratory, condensation of formaldehyde with the following compounds is said to have given these high yields of monomethylol derivatives: with acetone, 84%; with methyl ethyl ketone, 91%; with diethyl ketone, 75%, and with nitromethane, 64%. Reactions were carried out, it is claimed, by refluxing an activated compound like methyl ethyl ketone from a heated flask into a fractionating column packed with glass helices. Formaldehyde and sodium hydroxide catalyst were added slowly at the top of the column, and a large excess of ketone over formaldehyde was maintained in the reaction zone, according to the report. The monomethylol derivative is said to have been removed from the reaction zone by continuous rectification before self-condensation or secondary actions could take place. The sodium hydroxide is reportedly neutralized in the boiling flask to prevent further aldol condensations.

Use Electron Bombardment To Cause Polymerization

The possibility of making solid plastics from liquid raw materials by bombarding them with high-voltage electron beams is foreseen as a result of recent experiments reported by two scientists. Chemical means are usually used to initiate polymerization, but the scientists have found that a beam of electrons with energies of 800,000 volts, brought into the open air, is also able to cause such polymerization.

Most of their experiments were performed with tetraethyleneglycol dimethacrylate but they stated that various other compounds could similarly be polymerized with cathode rays. Among these, it is claimed, are styrene, acrylonitrile, and methacrylates. The recent experiments were performed with a modified million-volt X-ray machine.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

A new type adhesive to meet storing and shipping needs reportedly will seal tight and open easily. Used now in palletizing, it is described as strong enough to hold stacked merchandise and as breaking clean and fast in unstacking. (No. 718)

A new refractory coating, said to give a smooth, hard surface for greater reflection of heat and to reduce wear of firebricks, is easy to apply by brush or spray, and will not crack off or flake, the makers state. (No. 720)

A new joint sealing compound is claimed to hold carbon tetrachloride, ethylene dichloride, benzene, toluene, xylene, propane, chloroform, methyl chloride, and many other difficult-to-hold compounds. (No. 721)

A new coating for polystyrene plastics, designed for use on the reverse side of clear plastics, gives a finish almost as brilliant as plating or metallizing, according to the manufacturers. (No. 722)

A new primer that wets rust is reported capable of locking paint film—particularly vinyl—to surfaces having adherent rust. Compatible with all finishes tried on it thus far, it reduces splitting of top vinyl finished to nearly zero, the makers claim. (No. 723)

"Electric sheets" of white, maize, blue, or pink mercerized broadcloth are on the market. Made with either single or dual controls, the sheets will operate from any 115-volt AC outlet. (No. 724)

For measurement of dry film coatings, a new easy-to-use, fast and accurate device is reported, requiring no outside source of power is reported available. Results are said to be independent of composition or thickness of base on which the coating is being measured. Base need only be electrically conductive. (No. 725)

A new vinyl plasticizer for use in sheeting, wire covering, shoe soles, and other compositions that must withstand severe flexing and stretching, is claimed to impart flame retardance and to have high performance on heat aging and aging in water, gasoline and oil. (No. 726)

New chemical resistant bags for shipping and storing organic substances like foods and fertilizers and many other chemicals are described as economical, easy to print, and highly resistant to water vapor. Made of paper coated with odorless and tasteless polyethylene resins, the bags are said to be strong and durable and to keep packed foods fresh. (No. 727)

Crystal-clear bonding of white styrofoam is reported possible using a vinyl-based cement now in use for cementing other plastics. This cement answers the need for an efficient, water-white, non-staining adhesive, it is claimed. (No. 728)

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BRANCHES IN ALL PRINCIPAL CITIES

NEWSLETTER

Would a quick Korean armistice send the chemical industry into a tailspin? "No," says General Hull, Army's Vice-Chief of Staff. Money already appropriated for defense is a hedge against disruption or dislocation, will keep industry boiling along for months—even years.

Typical of Washington thinking is the Senate Preparedness Subcommittee's recommendation for isoprene expansion—to provide increased production of butyl rubber.

With an eye toward possible bombing, Subcommittee Chairman Johnson (Texas) urges that a second isoprene unit be built some distance from the single plant now making it. He also wants additional butyl production dispersed from the two current output sites.

But while Defense officials are worrying about capacity in this country, the State Department is throwing away opportunities abroad.

We had a chance to improve our thorium supply position by a deal with India for an extraction plant there; and we had a potent bargaining tool: wheat. But the wheat was shipped with no strings, we missed a good bet, and now State is too embarrassed to discuss it.

Food, too, is a defense commodity, and figures just compiled by the Department of Agriculture point up the need for continuous expansion of fertilizer output—in spite of military calls for raw materials.

Use of nitrogen, phosphates and potash was up 25%, 8% and 28% last year (ending in June) from the year before. Total plant food use was 2½ times as great as the 1935-39 average—and 61% above such a relatively recent season as 1945-46.

Outlook for 1960: Ten million tons—a little over twice the present consumption—will be required.

Sulfur, chlorine and caustic are the "fair-haired" chemicals in DPA's eyes. Of the latest 114 certificates of necessity issued (while another 208 applications were denied) only three were for chemicals:

Southern Alkali Corp. (now Columbia-Southern Chemical Corp.) got a 50% write-off—dollar value undetermined—on a chlorine plant. Gulf Oil and Hancock Chemical each got an 80% write-off on \$586,390 and \$250,000, respectively, for sulfur recovery.

Largest of the certificates was Aluminum Co. of America's, for a \$115 million primary aluminum plant in Milam County, Texas.

Another firm, Spartan Aircraft Co. (Tulsa), is eager to get into aluminum. It has filed with DPA for a certificate to cover a 60,000 tons-a-year plant—all the way from bauxite—to cost \$102 million.

Chances are it will go through, but Spartan should take a look at Harvey Machine Co.'s troubles. They're paying RFC a whopping 4½% interest on a \$46 million loan to produce aluminum, half its profits are preempted for repayment, and RFC can kick out the management on 30 days' notice. That's shooting from a hundred yards behind the tee.

NEWSLETTER

Active company of the week is Heyden Chemical Corp. Its board of directors has authorized a \$5 million preferred stock issue to raise part of the capital for an \$8½ million expansion program.

Slated for higher production are antibiotics, pentaerythritol, toluene derivatives and other specialty products at Princeton, Garfield and Fords, N.J.

Heyden is also half-owner (with Shawinigan Chemicals Ltd.) of a new Canadian subsidiary which will construct a \$2 million formaldehyde (30 million pounds a year) and pentaerythritol (3 million pounds a year) plant. This will represent first production of pentaerythritol in Canada.

Further expansions, new products and ventures kept the news pot boiling this week:

Rohm & Haas is upping its methyl methacrylate output.

Pennsylvania Salt Manufacturing Co. is expanding its production of hydrofluoric acid.

A major producer of alkyl benzene expects to be making 300 million pounds a year by next summer—a higher annual production rate than the entire industry's in 1950. And no sales problem is foreseen.

Here's more benzene from petroleum: Standard Oil Co. of Calif. is getting it from its hydroformer products, and output will be jumped when its new Platformer starts operating.

First domestic source of quartz crystals has been discovered in Northern Utah. Barite Corp. is mining it, and entire output will go under contract to the Government stockpile. Until now all stockpile-specification crystals have been imported—mainly from Brazil.

Pure Oil Co.'s carbon bisulfide-from-natural gas process has been sold to Food Machinery & Chemical Co. Whether it will be licensed to other producers hasn't been decided.

Upjohn & Co. is readying production facilities to make large quantities of Compounds B and F, related to cortisone.

Texas City Chemicals, Inc., is a new name in the industry. Formed by a group of prominent oil men, the firm has a certificate of necessity to construct a sulfuric acid and dicalcium phosphate plant.

The \$4½ million project involves purchase of 400 tons per day of weak acid from Carbide & Carbon, "beefing" it up, and using it to treat 200 tons per day of Florida rock phosphate. Chemical Construction Corp. will build the phosphate plant, probably the acid plant, too.

Perhaps it's a trend; and if so, the softening of the textile market may be responsible. Textile processors are buying more and more pigments—which are harder to apply than dyestuffs but usually cheaper.

DPA statisticians have been busy with their calculating machines, have analyzed all certificates of necessity granted before the moratorium went into effect August 18.

Total number granted for chemical products was 195, for a total capital outlay of over \$700 million. Per cent certified was only 55.3—fourth lowest (after lumber, utilities and textiles) in 28 industry categories. Coal and coke, with 80.9% write-off, had the highest figure.

New use for napalm: burning sugar cane. Hutchinson Sugar Plantation Co., Hawaii, has ordered trial lots for experiments.

... The Editors

BUSINESS & INDUSTRY



SENATOR MAYBANK (left): Administration chiefs* would like some changes made.

Price Ceilings in a Fog

Administration sponsors bill S.2092 to revise Capehart amendment to Price Regulation CPR-22. Claim: the amendment is unworkable.

New bill would curb now-permitted cost boosts. Manufacturing Chemists' Association representative points out possible new price inequities.

Many manufacturers will await outcome before changing from the general ceiling prices (GCPR). In the offing: more tailor-made regulations.

It would be a toss-up this week to decide who is more harassed: the Office of Price Stabilization or chemical producers trying to establish prices under Regulation CPR-22. The OPS, already beset with a near-myriad of pricing problems, is also waging a hold-the-line battle on Capitol Hill in Washington. Specific target: to strike out the Capehart amendment to CPR-22, substitute a new administration-backed bill S.2092.

Now manufacturers who have plowed through the reams of calculations needed to file under CPR-22 may find their labor lost. On top of this blow, the new proposal would deny or limit many of the Capehart-allotted price advances based on cost increases.

Makers' Spot: The producers' plight was presented in plain talk by John A. Sargent, executive vice-president of Diamond Alkali Co. in hearings on S.2092 before the Senate Banking and Currency Sub-Committee. Speaking as representative of the Manufacturing Chemists Association, Sargent testified that the new bill would be no clarification of the Capehart plan, which recently became law.

The MCA representative objected to S.2092 on the grounds that the manufacturer would actually have to absorb more cost increases than under the pre-Capehart CPR-22 setup.

OPS Views: Despite OPS attempts

* Defense Mobilizer Wilson (center) and Price Stabilizer DiSalle (right).

to "clarify" the Capehart amendment, the issue of price controls for the chemical industry is still very much up in the air. OPS is finding the chemical business a much tougher control problem than most. This week, for instance, the price agency gave up in the attempt to control the intricate trade in botanicals.

Under Controls: Because of the complexity of chemicals manufacture, it is bruited about that the industry will, for the most part, steer clear of CPR-22. Many manufacturers now prefer to remain under the General Ceiling Price Regulation (GCPR) of last January, at least until the CPR-22 controversy is settled.

But GCPR is still intended as an expedient. The trend in price controls is toward special regulations for various sectors of the industry. Both OPS and the chemical industry expect, with some reason, that the new trend will be an improvement.

Powerless Northwest

Sales efforts of the Bonneville Power Administration in the Columbia River Valley have been almost too successful. This, the driest summer in twenty years in that region, forced BPA to drop about 245,000 kilowatts of interruptible power on September 17. This represents less than half of the 600,000 kilowatts considered in short supply, but the move will affect the power supply available to nine electrochemical units in the area.

Interruptible power is that which is available for sale above the needs of domestic and contract customers. Largest of the industrial groups to be affected by the BPA cut will be the magnesium and aluminum plants served—Kaiser has already shut down two of its seven pot lines at Meal, Ore., and others are considering where to economize on power. There is a good chance, however, that certain producers may receive special treatment because of the pressing need for their output.

Already Penn Salt's chlorate—for munitions—plant and the General Service Administration magnesium plant at Spokane have been excepted from the order. The four aluminum plants [Reynolds (2), Alcoa and Kaiser] obtain about 25% of their power

on an interruptible basis and furnish about 50% of the nation's aluminum. Consequently Federal officials may decide that the aluminum is essential to the defense effort and order Bonneville to effect the power saving in another manner.

Steam Power Costly: There are 120,000 kilowatts of steam power available to make up for the hydroelectric cutback. But the steam-generated power cost is about 8 mills per kWh, four times the cost of 2 mill hydroelectric power.

Other facilities that will be affected by the power drop include the calcium carbide and ferro alloys plants of Union Carbide and Carbon Corp. and Pacific Carbide and Alloys Co., Penn Salt's caustic-chlorine unit and Victor Chemical Works' new phosphorus facility.

Cases Vary: Each of these companies will be affected to a different degree by the power cutback since the percentage of interruptible power used by each is not the same. And those who have contracts for power on a twelve month basis will not be affected at all by the present order.

Normal power flow will not be resumed until next February or April, depending upon weather conditions.

A wet winter can mean a lot of water.



Follows Nichols

HENRY H. FOWLER, a Washington lawyer and for almost 12 years a government official, is now Deputy Administrator of the National Production Authority. As No. 2 man he replaces Thomas S. Nichols of Mathieson Chemical Corp., who resigned last June to return to his firm. Fowler was assistant general counsel first with the Office of Production Management and later with the War Production Board during the last war. He first entered government service in 1934 and has been with RFC and TVA.

Senate is even now in hot debate over a bill to reorganize the Department (S. 1149). Coming in for particular fire is what some senators call "duplication" of research.

Under the bill Secretary Brannan would have to make a survey of all the Department's research stations to eliminate all overlapping of functions. New research stations could be set up only after the Secretary had determined that existing federal-state facilities could not be developed to fill the need.

"No Duplication": But Secretary

Brannan insists that there is no duplication in the USDA's research activities.

He says that last February he grouped all research functions under the Agricultural Research Administration. He admitted that some agencies, such as the Forest Service, are conducting research not under the ARA, but maintains that the Pace subcommittee of the House Committee on Agriculture gave the Department a clean bill a year ago. Whether or not the bill goes through, it is unlikely to affect the allocation of research funds. People on the operational level are not too concerned; if anything, they think, the hubbub may result in increased funds if Congress feels operations are more efficient after the bill is passed, and thus deserve more support.

Looking Ahead: The future situation for certain vegetable oils used in industry is not particularly good, and the Department has lined up a battery of research projects to dig into the possibilities of substitutes. The Munications Board, busily stockpiling strategic castor oil, palm oil, and coconut oil, is expected to look with favor on the projects. It is hoped that this will help loosen purse strings on Capitol Hill.

With tung oil tied up in China, castor oil in Brazil, coconut oil in the vulnerable Far East, and palm oil in Africa, emphasis is being placed on chemical modification of domestic oils and fats which would be readily available in event of an emergency.

Some typical proposed problems are: (1) investigations into the uses of sebacates (castor oil) as special lubricants and greases, and in tough filament nylon; (2) development of a drying oil as a substitute for dehydrated castor oil; (3) the search for a synthetic rubber modifier to replace dodecyl mercaptan (originally from coconut oil); (4) preparation of an emulsifier for Navy disinfectants to replace lauryl alcohol (coconut oil); (5) development of a material for use in tin plating, and the cold rolling of steel, to carry out the function now done by palm oil.

Military Marriage: The typical problems proposed give a strong hint of the Department's reaction to increasing Congressional pressure. It appears that USDA is setting up house-keeping with the military: All of the proposed research activities are concerned with military objectives. Apparently USDA wants to stay out of the controversy over subsidizing normal research (CW, Sept. 8) at this time, and tie its program to the star of military necessity.

Current List of DPA-Certified Chemical Facilities

COMPANY	LOCATION OF FACILITIES	PRODUCT	AMOUNT ELIGIBLE	PERCENT
Wallace & Tiernan Products, Inc.	Belleville, N.J.	Pharmaceuticals	60	
The Atlantic Refining Co.	Point Breeze Philadelphia Refinery Charlotte, N.C.	Anhydrous ammonia	3,400,000	50
Lion Oil Co.	South Charleston, W. Va.	Anhydrous ammonia	30,452,000	50
Food Machinery & Chemical Co.	Woodbury, Ala.	Anhydrous ammonia	2,503,000	50
Woodward Iron Co.	Whiting, Ind.	Anhydrous ammonia	6,000,000	50
Standard Oil Co. (Indiana)	Chicago, Ill.	Elemental sulfur	1,720,000	80
The C.P. Hall Co. of Ill.	Odessa, Tex.	Carboxylic acids	130,830	60
Sid Richardson Carbon Co.	Ector County, Tex.	Elemental sulfur	1,741,000	80
Phillips Chemical Co.	Houston, Tex.	Elemental sulfur	500,000	80
Shell Chemical Co.	Texas Gulf Coast	Anhydrous ammonia, methanol, acetylene	38,260,000	50
Phillips Chemical Co.	Port Neches, Tex.	Ethylene glycol	60	
Jefferson Chemical Co., Inc.	Port Arthur, Tex.	Sulfur	586,390	80
Gulf Oil Corp.	Long Beach, Calif.	Sulfur	250,000	80
Hancock Chemical Co.				

Limestone Lore

Rapid depletion of certain domestic mineral raw materials is causing industrialists to devote more and more attention to basic resources; and competent studies of the supply of these materials are badly needed. To fill part of the need, the B & O Railroad has recently published a clear, comprehensive, and extremely valuable study of the high-calcium limestone deposits along its right of way.⁶

Limestone is certainly a basic mineral raw material. Only two groups, coal, and sand and gravel, exceed the volume of limestone produced annually. Particularly important to the chemical industry, limestone and lime, its largest single derivative, are used in the production of cement, soda ash, calcium carbide for acetylene, calcium cyanamide, water purification materials, glass, and many other products.

No Shortage, But . . . High-calcium limestone (95% or more calcium carbonate) is the premium product of the limestone industry. While limestone itself is abundant, high-calcium stone is not only much scarcer, but many deposits are remote from industrial areas.

Since many deposits of high-calcium stone are of limited size, and since many deposits now being worked are scheduled for abandonment (either because of economic limits for working having been reached, or because of depletion), there has been much concern recently that U. S. reserves may be dangerously near running out. But the B & O geologists see no real shortage.

While companies can regard only relatively small reserves as proved, and production tonnage is rapidly increasing, B & O points out that there is no danger of the U. S. running out of high-calcium stone for centuries.

Admittedly, there are few rock formations which contain high-calcium stone, but the country is fortunate in having a few extensive formations of consistently high purity.

Cost Factor: But in considering limestone supply, cost factors are more important than actual quantity. Perhaps the greatest single cost in the use of limestone is transportation from source to point of use. Prime source of increasing cost is the necessity to continually move farther afield for supplies as local deposits are used up.

In this respect, the B & O book is most valuable in pinpointing the deposits available over a large part of the East and Midwest. A separate section is devoted to the deposits in Illinois, Indiana, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia, complete with geological maps, locations, depth, output, and method of production of all deposits.

Second major factor in costs is the method of production. Best method is quarrying. Mining can never produce stone as cheaply as surface operations, but there is a limit on the amount of cover that can be stripped economically. A point is inevitably reached where mining becomes cheaper than quarrying.

It is this that makes accurate knowledge of the available deposits necessary to determine how far away from the plant a quarry can be before it becomes cheaper to mine it closer to home. Many factors are involved, and the B & O book will definitely be a great aid in deciding just where and how to get limestone. In an era of deep concern over receding basic resource supplies, such a study of one material is a friend indeed.

At the Ready

Specific suggestions for chemical plants to follow in civil defense preparations were given by the Federal Civil Defense Administration last week in a new booklet, "Civil Defense in Industry and Institutions."

Stressing the need for adequate planning now, the booklet outlines what management should do, the personnel needed and the plant facilities which should be checked. Copies may be obtained from the Government Printing Office for 25¢, with quantity discounts.

The booklet points out that most civil defense set-ups are like municipalities, and as such, most plants have a service nucleus, set up to supplement municipal services. In case of attacks, plant fire-fighting organizations, police systems, guards and medical services would have to be self sufficient, since the municipality could not be counted on for immediate help.

A survey of hazards characteristic of chemical plants, such as toxic gases, flammable solvents and strong mineral acids should be made, since normal protective devices may not function upon attack. In time of war, the release of damaging substances would not only add to casualties but would

hamper rescue and recovery work. Hence, emergency protection measures should be decided upon.

The mechanics of adequate civil defense are outlined. Personnel needed and their qualifications and the physical set-up are listed.

The need for duplicate records, which would not be destroyed in case of an attack, is stressed.

Included is a checklist of 20 other civil defense publications which are sold by the Government Printing Office. These outline more specific and detailed information on different facets of the defense problem.

Purpose of the booklet is brought out in its introduction. "The best way to cope with disaster," it reports, "is to be thoroughly prepared to meet it. Any steps you take now to protect your establishment will minimize the effects of a major catastrophe."

Still Pioneering

A San Francisco engineer has developed a synthetic drying oil and is producing it on a limited scale for West Coast consumption. Its main selling point: It's cheaper than comparable natural oils.

The elderly gentleman who has shown once again that the lone inventor has not completely faded away is Hans Jansen, a Danish chemical engineer* who has followed his profession in this country since 1926.

When the price of linseed oil soared to a high of about \$4 per gal. in late 1946, Jansen decided to see whether he could develop a synthetic drying oil at a much cheaper price. Through most of 1947 he tested over 300 compounds, none of which suited him completely. The main problem was getting the oil to clear sufficiently for commercial acceptance. Finally having solved the problem to his satisfaction, Jansen persuaded a traveling paint salesman to carry Durolin, as he called the product, as a side line. The first sale was made in early 1948.

The raw materials for Durolin, according to Jansen, are soybean oil—about 25%—natural gum, chlorine and "common chemicals." Currently Jansen is finding the increasing cost of soybean oil a little annoying, but says it won't raise the cost above linseed oil. But chlorine is hard for a "little man" to get.

Although he has distributed the product in a small way for several years, most of these sales were in the nature of tests, and it was not

* High Calcium Limestones in the area served by The Baltimore and Ohio Railroad, John A. Ames, Industrial Geologist, Baltimore and Ohio Railroad.

* B.S. in chemical engineering from the University of Copenhagen in 1909, where he also did graduate work in chemistry.

until early 1950 that Jansen had all his results, decided to seek wider markets for his products. By this time he had added three more items, all based on Durolin Paint Oil, to his line: Duron 17, a liquid hardener for concrete and magnesite floors; Duro-Seal, a sealer and primer for wood, wall board, stucco and cement; and Durolin Reinforcing Oil, an elastic binder for paints. Durolin 17 contains an added waterproofing compound; Duro-Seal is boiled-down Durolin with gum and chemicals added; and Durolin Reinforcing Oil is Durolin made with a high gum content and added chemicals.

The main selling point of Durolin is that it is some 20% cheaper than comparable natural oils. In addition, it separates more slowly from pigments and does not form skin on the surface when exposed to the air for several days. After 4½ years of weathering, paints made with Durolin show no signs of cracking, peeling or blistering. Of particular interest is the fact that Durolin allows paint to be applied directly to wet walls with no harmful after-effects. Important to varnish makers, processing temperatures of only 135°C are required with Durolin—considerably lower than when natural oils are used.

Small Capacity: Limited at present to a still capacity of 259 gal. per day and a settling capacity of 250 gal. every two days, Jansen is confining his present market area to Northern and Central California. In addition to limited capacity, freight rates prohibit shipping Durolin products east of the Sierras.

If current financing plans materialize, however, Hans Jansen Co. will reorganize and build producing units throughout the Middle West, East and Eastern Canada, with products marketed in 1- and 5-gal. cans and 30- and 55-gal. drums.

Scrub Oak Pulp

The University of Florida process for the continuous production of chemical fiber from conifers and hardwoods will soon be in the pilot plant. Production goal: three to six tons a day. The process will be used for producing high strength Kraft pulps from southern pine as well as dissolving pulps from scrub oak.

University researchers have been working on the process for some time, but have been unable to get it out of the laboratory because of limited funds. Now, however, several manufacturers of pulp-making equipment have agreed to furnish (without cost) necessary pilot plant facilities.

Three Steps: In brief, the process consists of three steps: First is a rapid steaming to soften the lignin of the mill-size chips. This is followed by a mechanical subdivision of the chips—without injury to the fiber length. Finally, the expanded chips are treated continuously with regular Kraft liquor at elevated temperatures for about fifteen minutes. The product is a high quality pulp for many chemical uses.

One of the big obstacles to the utilization of scrub oak has been the fact that ordinary debarking procedures would not do the trick. This has been overcome by the use of an air flotation table (*CW, June 16*). But even so, many pulp producers have felt that the woods operation would prove too cumbersome for commercial production.

The University of Florida now reports that debarking equipment can be made in a portable form that can be taken to any point where the wood is harvested. It suggests further that a pulp producer could set up a by-product tannin industry which would defray part of the costs of the wood gathering.

Unquestionably the process has attractive commercial aspects. It has aroused a lot of interest, particularly in the South. (In Florida alone there is an estimated 5000 sq. mi. of scrub oak forests, half of all the forests in the South are hardwoods). But full economic evaluation must await successful runs in the pilot plant.

FOREIGN

Brazil: A new company, Geon DO Brazil, is building plants at Sao Paulo which will produce 6 million tons of Geon polyvinyl plastics annually. Products include vinyl chloride monomer, Geon polyvinyl chloride resins, and Geon plastic compounds.

Engineering work is well under way and the facilities are expected to go on stream in late 1952 or early 1953.

The new firm is jointly owned by the B. F. Goodrich Chemical Co., a division of B. F. Goodrich Co., and S. A. Industrias Reunidas F. Marrazzo. The American firm is furnishing the design and manufacturing techniques, but the plant will be operated by Brazilian personnel.

Argentina: Commercial production of citric acid by the fermentation process in Argentina is expected to reach 240,000 kilos soon. According to reports, this will be sufficient to meet annual domestic requirements.

Germany: The Allied High Commiss-

sion for Germany has given permission to "A. G. fuer Stickstoffduenger" Knapsack/Koeln, to begin production of basic phosphorus and chemically pure phosphoric acid. The firm plans to install an electric furnace with a capacity of 10,000 kw.

Australia: Exporters of chemicals to Australia will be restricted by a recent decision of the Australian Port Authorities Association to impose limitations on the quantities of certain chemicals entering Australian ports.

From now on no more than 75 tons of chemically pure ammonium nitrate can be unloaded at ordinary berths, and no more than 400 tons elsewhere (by special permit). Ammonium nitrate with organic material in it, and ammonium perchlorate are limited to 10 tons, provided they are cleared immediately, and 400 tons when unloaded at anchorage.

All permanganates, chlorates, nitrates, and peroxides, which may form easily ignited or detonated mixtures with combustible matter, will be limited to 20 tons a load. Sodium nitrate however, is not limited.

EXPANSION

Fluorine Removal: A \$100,000 scrubbing unit for removing fluorine compounds, probably as silico-fluoride, from waste gases from its elemental phosphorus production, will soon be placed into operation by Victor Chemical Works, Inc., at Mount Pleasant, Tenn. The new unit is the largest of three scrubbing towers installed by Victor for this purpose over the last eleven years.

Ferro-Alloys: Woodstock, Tenn., about ten miles north of Memphis, will be the site of a new ferro-alloys plant which is to be built by Chromium Smelting & Refining Co., a Canadian firm. Ferrochrome will be the principal product of the two 20-ft. electric furnaces.

Moreover, first operations have just begun at the new ferro-alloys plant of Electro Metallurgical Co. at Marietta, O. All of the ferro-alloys produced by the company at its other installations will be made at the new unit as well as a new ferrochrome for manufacture of stainless steel. The new plant represents a major share of the company's \$135 million expansion program.

More "Cold" Rubber: Output of the so-called "cold" type of general purpose synthetic rubber (GR-S) is to be increased by the government to a total of 75% of the planned GR-S total out-

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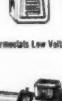
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BUSINESS & INDUSTRY

put of 71,720 tons per month. The current output of "cold" rubber accounts for only 50% of the present monthly synthetic rubber production of 53,770 tons.

Ammonia: Lion Oil Co. officials are scratching hard as they try to figure out where they can get the needed natural gas so that they can take advantage of their \$30 million certificate of necessity (50% write off) for a new anhydrous ammonia plant. Original location specified was Charlotte, N. C., but, as yet, it has not been found possible to obtain the needed gas supply. The company feels that it will be January 1 before the exact plant site will be determined.

Lion has also filed a registration statement with SEC for an issue of an additional 350,000 shares of common stock, presumably to provide funds for such expansions as the above. At the present price level this should provide nearly \$15 million in new capital.

Plastic Bags: The capacity for producing Cry-O-Rap plastic bags has been doubled by Dewey & Almy Chemical Co. with the opening of a new plant at Cedar Rapids, Iowa. The bags are for wrapping turkeys for roasting without basting.

Sulfur: Standard Oil Co. (Ind.) has started construction on a plant for the recovery of elemental sulfur (55 tons per day) at its Whiting, Ind., refinery. The plant is being erected by Fluor Corp. and will first extract hydrogen sulfide from refinery gases and then convert this to sulfur 99.9% pure. Operation is expected to begin about the middle of 1952.

Chlorine and Caustic Soda: Algonquin-Missouri Chemical Co. has leased the electrolytic chlorine plant at Redstone Arsenal, Huntsville, Ala. The company will take over on Dec. 14 when the present lease with Solvay expires.

Oxygen: Production capacity of National Cylinder Gas Co.'s new liquid oxygen plant at Miami, Fla. will soon be 5 million cubic feet per month. Other products will be acetylene and nitrogen. The new plant will supply the company's Florida outlet at Tampa with acetylene and nitrogen as soon as it is completed.

General Aniline & Film Corp: An insurance company is the source of a \$20 million loan just arranged by General Aniline. This loan is in ad-

dition to a \$10 million sinking fund loan arranged at the end of World War II. Money from the first loan paid for additions at the Anasco Div. at Binghamton, N. Y., the new high pressure acetylene pilot plant at Grasselli, N. J., and additions at Rensselaer, N. Y.

The new loan is intended for general corporate purposes. The company states that it will provide capital for General's new synthetic detergents plant at Doe Run, Ky. It is not to be used to finance General's interest in the newly-formed Alamo Chemical Co. at Houston, Texas (CW, Sept. 15).

KEY CHANGES . . .

Howard C. Greer: To treasurer, Chemstrand Corp.

Arthur W. Lucas: To assistant treasurer, Chemstrand Corp.

Charles P. Zorsch: To manager, agricultural chemicals section, Monsanto Chemical Co.

Wendell C. Peacock: From acting technical director to vice president and technical director, and board member, Tracerlab, Inc.

J. R. Van Wazer: From senior scientist to assistant research director, Phosphate Division, Monsanto Chemical Co.

Arthur W. Mohr: Elected president, National Agricultural Chemicals Association.

H. Gordon Smith: From vice president and general manager, textile division, to executive vice president, U. S. Rubber Co.

William E. Clark: From assistant general manager to vice president and general manager, textile division, U. S. Rubber Co.

Christian V. Holland: To chief of the Drugs and Cosmetics Section, and deputy chief of the Drugs, Alcohol and Solvents Branch, National Production Authority.

Robert A. Collins: From assistant superintendent, Brunswick, Ga., plant, to assistant plant superintendent, Hattiesburg, Miss., plant, Hercules Powder Co.

John M. Egan: From area supervisor to assistant superintendent, Brunswick, Ga., plant, Hercules Powder Co.

Gunnar H. Nelson: From supervising engineer to assistant plant engineer, Brunswick, Ga., plant, Hercules Powder Co.

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PRODUCTION

Benzene In The Backyard

New source of aromatic hydrocarbons: the liquid fraction formed as a by-product in the thermal cracking of hydrocarbons to make ethylene.

Design for a benzene recovery plant is pushed by Roosevelt Oil & Refining Co.; another company reveals sale of toluene made from cracking by-product.

Stringent raw material shortages have a way of opening up new raw material sources. And so it is in the present extreme shortage of benzene. At one time, this elusive chemical was almost wholly derived from coke ovens. But soon this fount will furnish only about half the total supply.

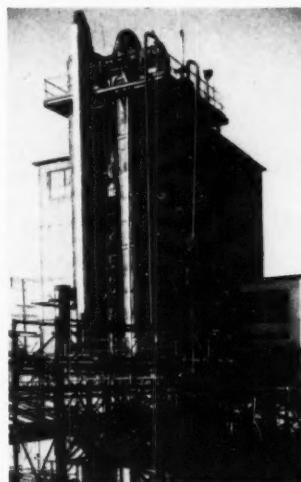
Latest source to be tapped will be the liquid fraction which is formed when gas oil is cracked to produce ethylene (see p. 19). Dow Chemical Co., which now gets a good portion of its ethylene supply from its gas oil cracking operations at the company's Midland, Mich., plant, recently became interested in recovering the benzene and toluene formed as by-products of the process. And process engineering plans began to take form.

Dow Process: A process developed by Dow will be used for the recovery of these two valuable aromatic chemicals. But the actual operations will be carried out at the plant of the nearby Roosevelt Oil & Refining Co. at Mount Pleasant, Mich. Benzene from this plant will be returned to Dow for conversion to aniline, phenol, diphenyl or any of the host of benzene-derived chemicals that are manufactured by Dow at Midland.

Roosevelt, however, will not be the first to recover aromatic hydrocarbons from the liquid fraction formed as a by-product of ethylene production. Tank car lots of toluene, derived from this source, have been shipped for some time (CW, Aug. 4) by Carbide and Carbon Chemicals Co. Carbide has no comment concerning possible benzene production from the same source but some experts feel that benzene may be being produced.

Unique Udex: But Roosevelt's plant will be unique. It will be the first unit to employ the Dow-developed Udex process for benzene and toluene recovery from the ethylene-derived liquid fraction. The Udex method is a solvent extraction process in which diethylene glycol serves as the selective solvent.

The Udex process is the outgrowth of long-time Dow research on the



DOW'S PHENOL PLANT: From a problem, a process.

problem that was presented in the operation of its chlorobenzene plant. In this unit only a portion of the benzene reacts on each pass through the reactor. The unreacted portion is recycled after separation from the product. The impurities present after one cycle are not sufficient to interfere but they soon build up to the point where they have an adverse effect on the reaction. At first, this problem was solved by removing a portion of the unreacted benzene from the system after each cycle so that the concentration of the impurities could be kept at a workable level.

But this solution is never suitable to a plant operator for long. After several years' study, Dow developed the use of diethylene glycol (DEG) for cleanup of the recycle benzene. When the benzene shortage arrived, Dow adapted its already-used DEG solvent extraction (Udex) to recovery of aromatic hydrocarbons. Although Udex will be first used on the ethylene

cracking stocks, Dow states that the process is suitable for separation of benzene and other aromatic hydrocarbons from other hydrocarbon mixtures. Udex is licensed by Universal Oil Products Co.

Platreating: In addition to its utilization of Udex, Roosevelt's plant also has some other unique features. It has a Platforming unit under construction which will operate on a narrow boiling range naphtha cut for aromatic production. Hydrogen from the Platformer will be consumed by a new-type hydrogenation unit, a Platreater. In this unit hydrogen will saturate the olefins and diolefins in the aromatic distillate stocks from the thermal cracking units as a by-product of ethylene manufacture. The thus-purified stock is then ready for Udex extraction.

This new benzene source is not a solution to the benzene shortage, for many ethylene plants use propane as the charging stock. However, it will be of great assistance, under present conditions; might even make ethylene producers look more favorably on gas oil as a charging stock for ethylene.

Riding on Nylon

Engineers and industrial machine designers are keeping a sharp eye on a new nylon bearing slated to go on the market October 1. Called the Nylined bearing by its manufacturer, Thomson Industries Inc., it is taking the spotlight as the brightest prospect for a really successful nylon bearing.

Chemical production men are particularly interested in a good nylon bearing for its relative inertness and corrosion resistance, and the fact that lubrication is not necessary. John B. Thomson, president of the company, sees the new bearing as particularly adaptable to the needs of chemical companies, and will cultivate them as one of his major markets.

Good, But . . . Nylon, as a bearing material, has come in for a lot of attention from industrial people, and has been pushed by Du Pont. Performing better than any other material now in use under adverse lubricating conditions, or with no lubricant at all, it is tough, resilient, and highly resistant to abrasion. Nylon not only is inert and corrosion-resistant, but can take temperatures above 250 F. Developing a tough, glazed surface, it has a very low rate of wear.

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Walls Were Not Needed

Contrary to widely circulated rumors, some a little on the gleeful I-told-you-so side, Corn Products Refining Co.'s wall-less buildings at its Corpus Christi plant have just completed two years of successful operation. Because the design had never been tried before for this kind of plant, designers built the plant so that walls could be added if necessary. But after two years of operation nine of the ten buildings are still without walls. Only the "sugar house" (left in the picture) has succumbed to immurement to provide better temperature control during the crystallization period.

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or machined nylon bearings were tried. Thermal expansion and moisture absorption caused significant dimensional changes. Cold flow (creep) made it inadvisable to press fit nylon bearings (the cheapest and quickest method of installing). The thickness of these early types caused seizure due to stress deformation which distorted the bore of the bearing. These and other problems braked the enthusiasm of most engineers.

Nylined the Answer? But the material was too promising to drop; Thomson enlisted Du Pont's aid and went to work. After some two years' research they are now ready to bring out their answer.

The new bearing consists of an outer sleeve of inexpensive metal, a thin lining of Du Pont's FM 10001 nylon bearing material, and two retaining rings. The liner is provided with a narrow slot, or compensation gap, which interrupts the circumference.

By using the thin liner principle, Thomson claims the new bearing overcomes the defects caused by the thickness of the nylon wall. Internal stresses are said to be negligible, and any slight change is taken up by the compensating gap. Thermal and

moisture-caused dimensional changes are also taken up by the compensation gap. The company points out that the Nylined bearing can be rapidly installed by press fit or clamping methods.

In addition, the company maintains that since the outer wall is of metal, the new bearing does not have to use an excess of nylon in order to gain the necessary structural strength.

When all these advantages are combined with the original properties of nylon as a bearing material, it looks as if Thomson has come up with a tool of great value to industry. The chemical industry, particularly, will take a long look at the new bearing.

EQUIPMENT

Flat Electric Heating Element: Flat surfaces for contact heating and a thin section for convection and air flow are provided by Syntron Co. in a new thin, sheathed electric heating element. Its major use is in industrial heating equipment such as kettles, ovens and driers, and for immersion heating of liquids.

The new units are 5/32-in. thick, are furnished in heated lengths up to 10-ft. and in widths of 33/32 and 17/32-in.

Vapor Purifier: A dry scrubber purifier with two-stage separation, designed for use where extremely clean vapor (1.0 ppm total solids or less) is required, will be brought out by the Centrifix Corp.

Primary stage separation is done by a rectangular-shaped anti-turbulence shield; secondary separation employs either upflow or downflow purifiers enclosed within the anti-turbulence shield. Advantages: separation efficiencies of 99.9% or better for the purifier; elimination of the need for auxiliary baffles within the drums.

Liquid Storage Tanks: A new development in liquid storage tanks has been introduced by the Hammond Iron Works. Called Diafolute tanks, the new equipment is said to eliminate breathing and filling losses, prevent contamination or dilution of high purity products, exclude air, decrease corrosion of the inside tank shell, and reduce the fire hazard to a minimum.

It is all accomplished by a membrane, called Vulcalock. Attached to the inside periphery of the tank, the membrane rests on the surface of the stored liquid to act as a barrier between the liquid and the air in the tank and prevents vapor formation.

Pressure Indicating Control: An electronic differential pressure-indicating control unit, designed to indicate and control the differential pressure between a volume of corrosive gas and a surrounding gas, is being marketed by the Henry G. Dietz Co.

The sensing element can be 100 to 250 feet from the indicating control unit, and the unit may be modified to indicate pressures, temperatures, accelerations, and forces. To withstand the action of corrosive gases, the sensing element is constructed of such materials as Teflon and Monel.

Electronic Relays: Three new electronic relays, designed to meet specific laboratory performance needs, have been put on the market by Emil Greiner Co.

One of the new relays is claimed to be the only one with dc control, which eliminates pickup and capacitive effects, permitting the use of unlimited lengths of leads.

Automatic Control: A new automatic control, which provides continuous indication and record of the variable, and controls the machine to correct for any deviation from the control point, is being produced by Fielden Instrument Corp. It is said to be particularly good for continuous drying.

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Ethylene Chemicals—The Next Decade

By 1962, today's \$2 billion investment in the petrochemical industry will quadruple. Reason: Soaring demands for synthetics.

Ethylene-derived chemicals will be front-runners of expansion due to burgeoning demands for antifreeze, synthetic fibers, and plastics.

CW Report* analyzes major ethylene-chemical trends, comes up with predictions and warnings about petrochemical expansion pitfalls.

W. E. Kuhn—J. W. Hutcheson

Petrochemistry has brought a profusion of gifts to the layman and an even more extensive profusion of potentialities to the chemist and the business man. Today, the consumer, the banker, the investor—all are aware of the fact that petrochemistry is very much a "going concern". It has indeed come of age—but, it is far from mature.

The aim of this report is to look ahead, to indicate what may be expected from this vital young industry as it moves rapidly toward maturity during the next decade. The petrochemical revolution has barely begun; the outlines of its significance are only now becoming discernible.

Petrochemistry may well be the most important industrial development of the past several decades. It is setting the pace in the fast advancing age of chemistry. It is contributing a spectacular flow of new products of superior merit which are daily pushing our living standards to higher levels. It is creating a growing payroll. It is continuously adding to national wealth and security by making greater and more efficient use of precious resources.

One of the most convenient ways to get a proper perspective of an enterprise is to measure its size. How big is the petrochemistry industry? How big was it five, or ten, years ago? In 1940 there was an estimated capital investment of \$350 million in the petrochemical industry. Output at that time was in the order of 4,100 million pounds a year. Five years later the investment had shown a rapid growth to about \$1,200 million and output reflected the expansion by measuring 10,500 million pounds a year. Today the total investment is about \$1,950 million and output has advanced accordingly to a rate of 16,000 million pounds per year.

The present rate of expansion will continue, probably will not slacken

for another decade, if then. By 1962 the industry will begin to assume its permanent position in the expanding field of synthetic chemicals.

Another valuable measure of the magnitude of this industry is the growth in the number of petrochemical plants. A tremendous expansion has taken place in the last 20 years.

The total petrochemical plants of the U.S. a decade hence should represent an investment of four-fold today's investment and likewise a four-fold increase in annual production capacity.

Let us now narrow our considerations and examine a trend taking place inside the broad framework we have just outlined. In 1945 approximately 50% of the 8,800 million pounds of aliphatic chemicals manufactured were petrochemicals. By 1950 the figure had jumped to 70% for the 13,400 million pounds of synthetic aliphatics. At the present time, ap-

proximately 25% of all the chemicals being made in this country are petrochemicals. By 1962 the figure should be close to 50%.

ETHYLENE CHEMICALS

Within the petrochemical industry, the manufacture of ethylene-derived chemicals constitutes a tremendous industry in itself. And, they are only a part of the petrochemical story. Why are the ethylene-derived chemicals playing such a big role? There are several answers: Let's examine them—discuss and look to the future of ethylene-derived chemicals.

Ethylene is derived essentially from the pyrolytic cracking of refinery or petroleum field gases or gas oil. This supply of ethylene may be augmented from refinery gas sources by the separation of the ethylene normally present in the refinery gas—the result of the many operations in the modern refinery. Ethylene in turn is converted



AUTHORS: J. W. Hutcheson, W. E. Kuhn (Texas Co.) squint ahead for ethylene.

to its derivatives by one of several processes:

- (a) Direct oxidation
- (b) Reaction with halogen
- (c) Reaction with acids
- (d) Catalytic reaction with aromatics
- (e) Catalytic polymerization

As shown in the appended tabulation (see Table 11) the "commercial ethylene tree" comprises many products some of which are only a bridge to the end commodity. The most important of these materials are:

- 1-Butanol
- Ethylene oxide and principal derivatives
- Ethyl alcohol
- Ethyl benzene
- Ethyl chloride
- 2-Ethyl Hexanol
- Ethylene dichloride
- Ethylene dibromide
- Polyethylene

ETHYLENE OXIDE

We are justified in turning our attention first to ethylene oxide, inasmuch as it is an important chemical building block of the future. Ethylene oxide is produced either by direct oxidation of ethylene in presence of catalyst or through the well known chlorohydrin route. Approximately one pound of ethylene is required for the production of one pound of oxide in industrial operations. Therefore, one may easily think in terms of either ethylene or ethylene oxide.

Ethylene oxide, as such, is used as a fumigant and as a sterilizer for starch products and water soluble gums used in foodstuffs. However, these uses are small and relatively insignificant poundage-wise.

The essential chemicals made from ethylene oxide and an estimate of the pounds of ethylene oxide required per pound of end product are shown in Table 1.

Ethylene Glycol: Of the foregoing, ethylene glycol today places the heaviest demand on ethylene oxide. Ethylene glycol production by all processes¹ shows an increase from 151.5 million pounds in 1941 to 510.5 million in 1950. Mention must be made of the fact that while most of production of ethylene glycol is from ethylene oxide, some has been made from formaldehyde and carbon dioxide by the glycolic acid process. For both 1949 and 1950, production from this latter process is estimated at 100 million pounds per year. It is anticipated that the production figure for ethylene glycol for 1951 will reach about 632 million pounds; for 1952 about 740 mil-

TABLE 1
ETHYLENE OXIDE DERIVED CHEMICALS

Chemical	Lbs. of Chemical from 1 lb. of Ethylene Oxide
Ethylene Glycol	1.22
Acrylonitrile	1.02
Alkylolamines	1.20 (Ave.)
Polyglycols	1.2
Glycol Ethers	1.5 to 2.2
Non Ionic Detergents	5.7 Approx.

lion lbs. These figures are based on plants which are now being expanded and on new plant construction.

To arrive at the probable future of ethylene glycol, a study of the end uses today and the probable end uses in the future and their magnitude is desirable. An estimated end use distribution of the 510.5 million pounds of this product produced in 1950 is shown in Table 2.

The future major consumption of ethylene glycol will undoubtedly be as automotive antifreeze. One of the prominent new synthetic fibers in the textile industry will call for amounts comparable with some of the other leading secondary but not minor uses.

One of the authors previously made a study of antifreeze consumption and this information is brought up to date in Figure 1.

The 1950 passenger car and truck census was approximately 43,500,000 total². This is an increase of a million over 1949. (The immediate post-war years showed greater increases and we are all aware of the reasons.) It is probable that the actual rate of increase will be less in the ensuing decade than it has been in the past several years because of limitation of our highways. Except for irregularities during and immediately following World War II, our total vehicle registration parallels our population curve reasonably well. Thus, by accepting the government population forecast and adjusting downward slightly the probable future vehicle registration due to highway limitation, one can estimate the future antifreeze market.

Using this census-vehicle yard-

stick, a total antifreeze market of 100 million gallons appears reasonable in 1962, of which 55 million gallons would be glycol type.

Secondary Uses: The largest industrial use today of ethylene glycol is in the manufacture of the explosive, ethylene glycol dinitrate. Its lower freezing point is a property of sufficient importance to warrant its continued use in dynamite and in the manufacture of other explosives. This demand for glycol appears to be fairly stable and well established.

The use of ethylene glycol in chemical manufacture, where humectant properties and low freezing points are of prime importance, should see a moderate increase. Its softening effect on fibers and films is resulting in its use where glycerine was once employed. (This shift has been prompted by glycerine shortages and price advances in glycerine rather than the superior properties of ethylene glycol.)

Ethylene glycol is used in the production of glyoxal, which is finding use for shrink-proofing viscose rayon fabrics. Admixed with other materials, glycol is finding increased uses as an industrial coolant, especially in closed systems, and also as an hydraulic fluid.

One outlet for glycol that needs study, because it is a new use, is in a new synthetic fiber which is an ethylene glycol-terephthalic acid ester. This product, Dacron, has reached the market in small quantities and is receiving excellent acceptance.

Synthetic Fibers: Because ethylene-derived chemicals are used in several synthetic fibers, a close look at the picture is justified. Actually, the eyes of many are focused on this expanding synthetic fiber business.

The picture is very complicated. The synthetic fiber field has increased at a very significant rate. Many new and truly outstanding fibers are being offered to the public today, although

TABLE 2
PROJECTED ETHYLENE GLYCOL DEMANDS

1950			1962	
	Million Pounds	Per Cent	Million Pounds	Per Cent
Automotive antifreeze	373	73.1	506	63.6
Synthetic Fibers	.5	.1	38	4.8
Cellophane and Papers	22	4.3	32	4.0
Explosives	29	5.7	32	4.0
Hydraulic Fluids and Industrial Coolants	14	2.7	19	2.4
Polyglycols and Glycol ethers	16	3.1	25	3.1
Alkyd Resins	6	1.2	9	1.1
Adhesive and Glyoxal	3	.6	6	0.7
Miscellaneous	27	5.3	100	12.5
Export	20	3.9	39	3.8
Total	510.5	100.0	797	100.0

some of them are in very limited amounts. When one considers consumer spending over the past 15 years, and realizes that consumer spending for clothing and accessories is second only to food—averaging around 11 to 13% of total consumer spending and averaging about 9 to 10% of our national income—one can readily see the importance of this field and realize the reasons for close scrutiny.

The total textile consumption is shown in Figure 2 coupled with the best estimate of the portion now occupied by the synthetics. The latter is broken down further in rayon and "other synthetics." The increase in the proportion of synthetics in the textile market is self-evident.^{20,21,22,23,24}

The rate of increase in synthetics to date is clear, but how can a growth curve logically and intelligently be predicted? It probably can't, but on the basis of the best estimates that can be made today one can translate the probable volume for these synthetic fibers in the future into raw material requirements for them.

A look at the chemical composition—based on raw materials—of the new synthetic fibers (Table 3) points to today's vital importance of ethylene derived chemicals.

Consideration of the ethylene glycol potential, makes it evident that one must consider Dacron. The future of this fiber is important because of its properties. It has excellent resistance to weathering, to rot, to mildew, to moths and to chemical attack. It is wrinkle resistant, which, coupled with other properties, certainly should insure tremendous public acceptance and thus a good future. On the basis of information compiled from various sources, it appears that the capacity, present and projected, for various synthetic fibers may result in an estimated 1953 production as follows:

Fiber	Million lbs.
Orlon	40
Dacron	35
Acrylon	30
Dynel	30
Nylon	150
Rayon	1600
Misc.	115
Total	2,000

But to estimate the ethylene glycol demand for the next decade requires a projection of the synthetic fiber industry. It seems logical to expect Dacron and other synthetic fibers to follow the normal growth curve such as was experienced after the introduction of rayon. On this basis, 38.1 million pounds of ethylene glycol (based

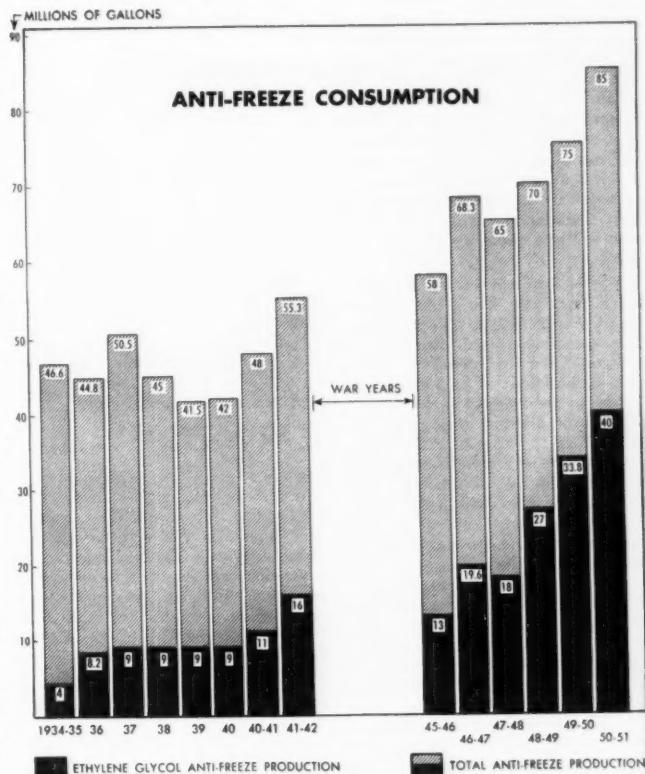


Figure 1

upon .31 pounds of glycol per pound of Dacron)²⁵ would be required for a 123 million pound production of Dacron in 1962. This is not as large a demand for ethylene glycol as some have predicted.

Piling up the individual blocks of information enables one to summarize the ethylene glycol demand that one might expect at the end of the next decade, i.e., as shown in Table 2.

Thus the 1962 demand will require approximately 653 million pounds of ethylene oxide (or ethylene) assuming all is made from ethylene oxide.

Acrylonitrile: The growth of the acrylonitrile market was relatively slow until last year and now appears to be due for very rapid increase, but pos-

sibly only a temporary one in so far as ethylene oxide is concerned. This is due to the fact that ethylene oxide is likely to be displaced in part by acetylene as the starting material for the manufacture of acrylonitrile.

The major end use of acrylonitrile has been in nitrile rubber (GR-A) and in plastics. Both uses should be relegated to second place by the potential demand for the new synthetic fibers utilizing acrylonitrile as a raw material. The production of nitrile rubber has varied from a peak production in 1944 to a post war low of about one third of the peak.²⁴

To assume a normal growth curve for GR-A is very dangerous because no curve is normal if political factors

TABLE 3
ETHYLENE-BASED SYNTHETIC FIBERS
Components Required

Fiber	Components Required
Dacron	Ethylene glycol, approximately 30%; Terephthalic acid, approximately 70%
Orlon	Acrylonitrile, essentially 100%
Acrylon	Acrylonitrile, approximately 85%; Vinyl acetate, approximately 15%
Dynel	Acrylonitrile, approximately 40%; Vinyl chloride, approximately 60%

are among the major influencing effects. Nevertheless, one can look at the possible situation for the future and try to evaluate the demand, bearing in mind that the recent increased demand is probably a reflection of the new uses of nitrile rubber. Heretofore, the chief use of this type of rubber was in products which must be resistant to gasoline and oil—such as tanks that require linings or in actual transfer lines. This use should continue.

Acrylic Synthetic Fibers: All of the acrylic synthetic fibers have almost complete resistance to mildew, moths, fungus, and acids, and are stable to sunlight. Their low absorbency is usually considered an advantage, although in some uses it is desirable to provide for moisture absorption. Orlon filament is being made in considerable quantities and Orlon staple will soon be available in quantity. This latter fact seems to confirm the opinion that although these fibers, in some instances, will be used individually because of their respective properties, their major future outlet may well be in staple form and incorporated with other fibers both natural and synthetic. The recent move of the military to incorporate certain percentages of synthetic fibers in clothing is concrete evidence of this trend.

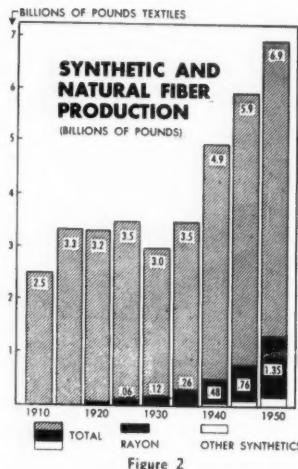
There is little doubt of the acceptance of these new fibers. On the basis of our premise of a normal growth curve similar to rayon, after the fabric had been established, the probable growth of these fibers can be estimated to reach a 1962 level of:

Fiber	Capacity	Acrylonitrile Requirements*	
		(Million Pounds)	
Orlon	140	140	
Acrilan	105	89.3	
Dynel	105	42	

*Based on
1 lb. Orlon requiring 1.0 lbs. Acrylonitrile;
1 lb. Dynel requiring 0.40 lbs. Acrylonitrile;
1 lb. Acrilan requiring 0.85 lbs. Acrylonitrile (est.)

A study of the trend in the plastic field as related to this raw material results in an estimate of a requirement of 60 million pounds a year in the next decade. In the miscellaneous use field the current 3 million pound requirement could well increase ten-fold in the next ten years and still be a small factor. The total demand on this analysis would be 383 million pounds of acrylonitrile in 1962.

Acetylene Competes: Before this 383 million pound acrylonitrile demand is translated to ethylene oxide one must evaluate developments in acetylene production. There is no



question in the minds of many that the major production of acrylonitrile sometime in the future will be from acetylene. The real question is how soon can acetylene be produced by any one of several new methods as an economically attractive rate. It is probable that the first significant commercial production of acetylene by one of the new methods will occur in the next five years and thereafter will show a healthy growth.

There are many problems relating to this first commercialization and include not only a choice of the method to be used for acetylene production, but also the development and/or selection of the separation, purification, concentration techniques and the elimination of polymerization and adverse chemical reactions of acetylene at each stage of its production. Happel and Marsel⁵ have outlined the situation well.

It is probable that ethylene oxide will continue to be used for acrylonitrile production. But after five years any increased demands for acrylonitrile may well be met by the use of acetylene as the raw material. Some 192 million pounds of 1962's 383 million pounds of acrylonitrile will come from ethylene oxide—a seven-fold increase over today's production.

Ethanolamines: Although the mono-, di-, and triethanolamines were introduced in the late 1920's, the demand has not been great until recent years. Today the demands far exceed the availabilities. One of the first major uses of the ethanolamines was in gas scrubbing, i.e., hydrogen manufacture, carbon dioxide manufacture, and hydrogen sulfide removal and recovery. Today this accounts for 17 to 20 per

cent of the available supply of ethanolamines.

Other major uses have been in textile specialities, emulsion cleaners and polishes, for solubilizing 2, 4-D and in agricultural sprays. The end-use distribution for the present production of about 33 million pounds of mono-, di-, and triethanolamines has been estimated⁶. (See Table 4.)

The ethanolamines and ethylene oxide itself are most promising as raw materials for detergents and a substantial growth of these detergents can be expected. The total soap industry is a large one and the entrance of synthetics into it is demonstrated in Figure 3.

The growth of the soap industry in recent years somewhat parallels the increase in population—indicating that we probably are nearly as clean as we will be—and if one can assume a similar growth trend based on the U.S. Census prediction, one can then estimate a trend for the future of soap and synthetics. This indicates the total soap market in 1962 will reach 3,800 million pounds—or an increase of about 6 per cent over the 1950 consumption.

In 1950 the total synthetics surface-active agents amounted to 664 million pounds of active ingredients; of this, 60 million pounds were ethylene oxide and ethanolamine-based products. The expansion of the ethylene oxide and ethanolamine-based detergents has, however, been hampered by limitations in the supply of these materials.

A projection of the ethanolamine market, with the realization that the detergent field and probably the use of these materials in gas scrubbing will be responsible for the major increases, indicates a 1962 demand for 90 to 95 million pounds. This, in turn, means a corresponding increase in ethylene oxide requirements for ethanolamine production from the present consumption of 27.25 million pounds to 75 million pounds in 1962.

A similar increase in ethylene oxide for the ethylene oxide-based detergents may also be expected, as shown in Table 5.

Other Uses: Other outlets for ethylene oxide include glycol ethers and polyglycols. These have been estimated to have consumed about 54 million pounds of ethylene oxide in 1950⁷. In the past this commodity has shown only a nominal growth and will probably show a similar growth in the next decade. Based on a review of their end uses, an estimated 70 million pounds of ethylene

TABLE 4
END-USE DISTRIBUTION OF ETHANOLAMINES—1950

Usage	TEA	DEA	MEA
Surface-active Amides	5.0	1.5	1.5
Ethanolamine Household Detergents			
Gas Scrubbing	5.0	1.5	2.0
Cosmetics	3.5		1.0
Textile Processing and Cleaning	1.0		
Agricultural: 2,4-D Salts	1.5	1.0	2.0
Agricultural Sprays	1.5	0.5	2.0
Emulsion Cleaners and Polishes	0.5	1.5	0.5
Other Alkylolamines			
Total	18.0	6.0	9.0

oxide will be required in 1962 for glycol ethers and polyglycols.

Summary: Thus, the demand for ethylene oxide as of today can be compiled and the estimated demand for ethylene oxide at the end of the next decade can be made on the basis of projections of the end uses of the important commodities. (See Table 5.)

ETHYL ALCOHOL

Ethyl alcohol is one of the ten top-volume organic chemicals and, along with ethylene oxide, is one of the largest volume chemicals utilizing ethylene as a raw material. Ethyl alcohol finds use as a solvent, antifreeze, and also as a chemical raw material to an extent that a host of other chemicals are affected by its price and availability.

Ethyl alcohol production processes are based on the raw materials from which the alcohol is made and fall into four categories:

(a) cellulosic materials, including waste sulfite liquors

(b) starchy materials, such as potatoes and grain

(c) materials containing sugar, such as sugar beets and molasses

(d) hydrocarbon gases

Up until the recent war years, grains and molasses were the primary raw material sources. Availability and price of these products—as well as the ease of their conversion to alcohol in relatively simple equipment—were

responsible for their selection. During the war, however, raw materials of all kinds were hard to obtain, yet the need for expanded ethyl alcohol facilities was urgent. It was during this period that synthetic alcohol from ethylene grew. See Table 31.

CONSUMPTION OF SOAP AND SYNTHETIC DETERGENTS

(BILLION POUNDS)

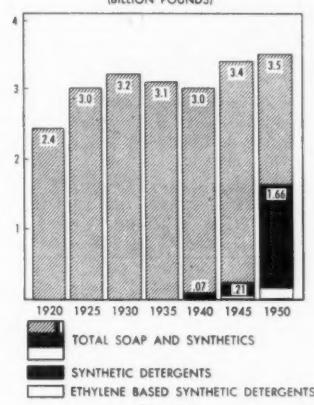


Figure 3

Annual production of industrial ethyl alcohol and the portion supplied by the synthetic product^{8,9,10} are shown in Figure 4.

A peak was reached in 1945 when

350 million wine gallons were produced as shown in Figure 4.

This high production level was required to help meet demands for butadiene in the synthetic rubber program. In this peak year of 1945, an additional 250 million gallons of industrial alcohol were supplied by the distilling industry and through imports. The production of industrial alcohol dropped rapidly in the post-war years to 130 million gallons in 1947. Requirements are again on the rise.

The steady increase in the production of synthetic ethyl alcohol since 1935 is evident. In 1950 over 100 million gallons were obtained in this manner. Figure 5 shows that the consumption of ethylene in the production of ethyl alcohol is estimated at 495 million pounds in 1950 as compared with 155 million pounds in 1940 and about 45 million pounds in 1935.

Antifreeze: The consumption of ethyl alcohol in antifreeze formulations shows wide yearly fluctuations, but in general, some 30 million gallons of volatile types (methyl-, ethyl- or isopropyl alcohol-based) have been required each year in the past. (Fluctuations in consumption are due primarily to variation in winter weather conditions.)

Ethyl alcohol is second only to water in value as a solvent and thus is employed in nearly all industries. Figure 6 shows the growth of this use. But there has been no striking increase in this use except during the war years. Over 45 million gallons were consumed in 1949—a sizable market.

Chemical Uses: Ethyl alcohol is employed in making hundreds of chemicals including acetaldehyde, ethyl acetate, acetic acid, ethylene dibromide, ethers, and ethyl chloride. Acetaldehyde is the largest volume chemical based on ethyl alcohol and its manufacture required about 70 per cent of the 100 million gallons of alcohol used in chemical production in 1948. In fact, the increased consumption of ethyl alcohol is due, almost entirely, to the increase in acetaldehyde manufacture (See Figure 7.)

The extension to the growth trend of total consumption of ethyl alcohol for chemical manufacture in Figure 7, allows for some cut-back in ethyl alcohol as a raw material for acetaldehyde and indicates that about 170 million gallons will be required by 1962. If, on the other hand, the bulk of the acetaldehyde manufactured were to continue to employ ethyl alco-

TABLE 5
PROJECTED ETHYLENE OXIDE DEMAND—1962

	1950		1962		% Increase
	Commodity Production	Ethylene Oxide Equivalent	Commodity Production	Ethylene Oxide Equivalent	
	(Million lbs.)		(Million lbs.)		
Ethylene Glycol (from oxide)	410.5	338.0	797.0	653.0	193
Acrylonitrile	25.0	24.5	192.0	188.0	767
Ethanolamines	33.0	27.5	90.0	75.0	275
Polyglycols and Glycol Ethers		54.0		70.0	130
Non-Ionic Detergents (Ethylene Oxide-Based)		19.0		60.0	316
Miscellaneous	20.0		70.0		350
	482.75		1,116.0		231

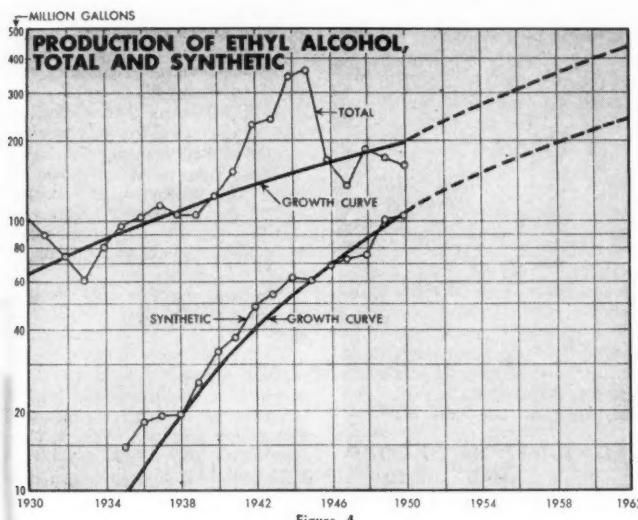


Figure 4

hol as a raw material, this value would be low.

With an increased reliance being placed upon synthetic rubber, and in view of existing plants which can utilize ethyl alcohol for producing

alcohol for synthetic rubber will continue at the present predicted rate of 180 million gallons annually for several years. Whether this demand will be in effect in 1962 is difficult to predict, but it is probable that at least a

TABLE 6
RAW MATERIALS USED IN ETHYL ALCOHOL MANUFACTURE
(% of total output)

Raw Material	Year					
	1945	1946	1947	1948	1949	1950
Molasses	29.2	26.4	21.7	42.8	36.3	31.5
Grain	43.3	31.8	16.0	10.4	3.3	0.7
Ethylene	17.2	38.6	53.5	42.1	46.9	57.5
Other	10.3	3.2	8.8	4.7	13.5	10.3

butadiene, it can be expected that the consumption of ethyl alcohol for this purpose may continue even after the national emergency. It is, therefore, estimated that the demands for ethyl

portion of the requirements will exist. It is predicted that about 150 million gallons will go to butadiene manufacture in 1962.

In summary, the following esti-

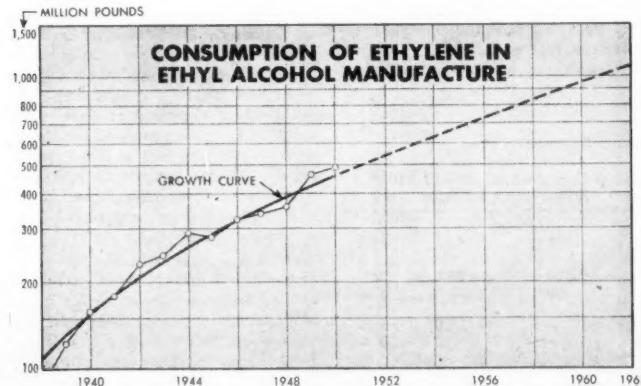


Figure 5

mates have been made for ethyl alcohol demands by 1962:

PROJECTED DEMANDS
FOR ETHYL ALCOHOL
1962

	Million Gallons
Antifreeze	30
Synthetic Rubber	150
Solvent	71
Chemical Manufacture	170
Other	10
	431

An extension to the growth curve of Figure 4 has been drawn to the 1962 annual requirements obtained by the end-use analysis. Certainly this is a logical extension.

The source of ethyl alcohol for future demands is complicated by economics, politics, and memories of past performances. The fluctuations in price of carbohydrate raw materials, some of which are imported, work a constant hardship upon alcohol producers using these materials. And government subsidy for the production of alcohol from grain is an ever-present possibility. So, in spite of the increased cost in ethylene over the past few years, it appears that it is the raw material of choice in the expansion of ethyl alcohol facilities. Although producers have released very little information on the cost of making ethyl alcohol from ethylene, it is known that in pre-inflation days appreciable quantities moved at about 20 cents per gallon. Ethyl alcohol has ranged in price from a low of \$0.20 to a high of \$1.145 per gallon.

In spite of the apparent demand for ethyl alcohol and the price at which it may be produced from ethylene, present and potential producers are reluctant to comment on expansion or construction of facilities.

An extension of the growth curve on the production of synthetic alcohol in Figure 4 indicates that, by 1962, at least 230 million gallons will be produced by this process.

And to produce 230 million gallons of synthetic ethyl alcohol by the present esterification and hydrolysis process would require about 1,110 million pounds of ethylene.

ETHYL BENZENE

Ethyl benzene, made by the reaction of ethylene and benzene, finds its greatest outlet in the preparation of styrene. Styrene is one of the major components of GR-S synthetic rubber and the major component of polystyrene, one of the most popular and widely used plastics. Since 1939 styrene production has climbed from less than a million pounds a year to

539 million in 1950^{1, 11}. This tremendous growth is illustrated in Table 7. During the war and in the immediate post-war years the bulk of the styrene produced went into GR-S synthetic rubber. Even though the demand for polystyrene plastics was growing rapidly molders had to be content with what was left from the GR-S program. Later in the post-war period when synthetic rubber production was cut back there still wasn't enough styrene. More users found more uses too fast. But in 1949, plastics usage of styrene exceeded that of synthetic rubber for the first time.

For a few months molders found supplies fairly plentiful but the international situation again focused attention on a synthetic rubber program and the demand for styrene has since been well ahead of supply. In 1950 there was a polystyrene resin production of 261 million pounds and if all copolymer resins and derivatives are included, it amounts to a 355.5 million pound production¹. The annual consumption of polystyrene^{12, 13} is shown in Figure 8.

Three major suppliers have embarked on an expansion program of styrene production, and it is estimated that 670 million pounds will be available in 1951 and something over 750 million pounds for 1952. At this rate industry can expect to reach an annual production of one billion pounds by 1955¹¹.

It is estimated that 600,000 long tons of GR-S rubber will be required in 1962. Since GR-S contains about 25% styrene, the potential demand for styrene for this end use will be about 335 million pounds.

An extension of the growth curve for the consumption of polystyrene indicates that at least 900 million pounds of styrene will be required annually by the plastics industry by 1962. Plastic molders have estimated that they could have used nearly 400 million pounds in 1950, had it been available¹³.

The total styrene requirement for both outlets in 1962 is, therefore, 1,235 million pounds. In the present commercial process about 640 pounds of ethylene are needed for each ton of styrene. At this rate, about 400 million pounds of ethylene will be required.

To produce 1,235 million pounds of styrene, benzene would be required in the amount of 1,070 million pounds or about 150 million gallons (total benzene consumption in 1950 was 187 million gallons). Certainly one of the limiting factors in styrene production has been the supplies of benzene.

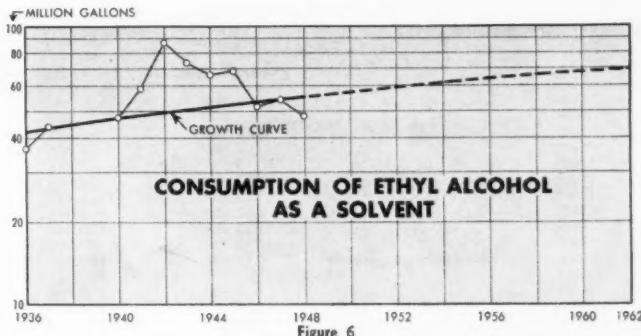


Figure 6

Recent announcements indicate that vinyl toluene, made from ethylene and toluene, will prove a suitable replacement for styrene in many applications. Such a compound, from more readily available material, would help eliminate the barriers to certain expansion programs, particularly in the plastics field. The overall ethylene requirements, however, would not be affected.

ETHYL CHLORIDE

Three methods are used commercially for the production of ethyl chloride. The oldest process involves the reaction of ethyl alcohol with hydrogen chloride. This method has been giving way to the reaction of ethylene and hydrogen chloride which now supplies the major portion of current ethyl chloride production. One new plant is reportedly making ethyl chloride by the controlled chlorination of ethane. Fundamentally, this should be the most economical of the three processes, provided an adequate market can be

found for the polychlorinated by-products. The U. S. Tariff Commission first reported the production figures on ethyl chloride in 1948. In that year 274.6 million pounds were produced, and in 1949, the production rose to 306.5 million pounds. [These data, together with annual production estimates¹⁴ back to 1935 are shown in Figure 9.

Estimates have also been made¹⁴ of the amounts of ethyl chloride produced by the hydrochlorination of ethylene. From these data it is possible to determine the trend in the consumption of ethylene for ethyl chloride manufacture. This information is also included in Figure 9.

Although no break-down is available on the amounts of ethyl chloride consumed in its various end uses, it is known that the major outlet is in the manufacture of tetraethyl lead. The manufacture of ethyl cellulose also requires ethyl chloride in considerable quantities. There appears to be

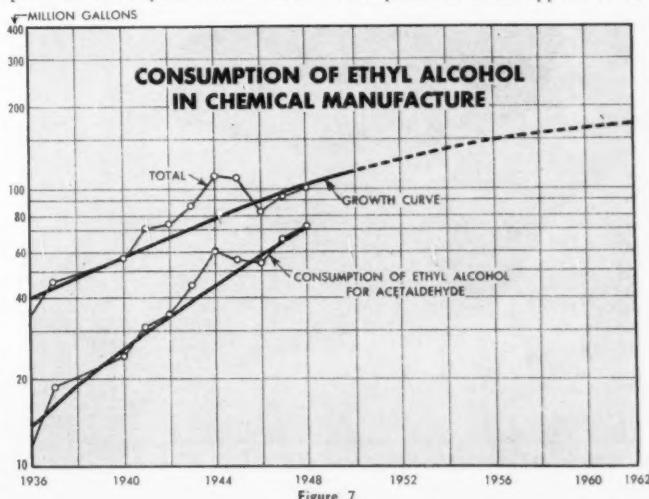


Figure 7

Table 7
STYRENE PRODUCTION AND ETHYLENE REQUIREMENTS
(Thousand Pounds)

	Styrene Production	Ethylene Required
1938.....	203	65
1939.....	834	267
1940.....	2,409	772
1941.....	4,559	1,461
1942.....	9,675	3,101
1943.....	97,655	31,300
1944.....	349,367	111,977
1945.....	362,160	116,077
1946.....	405,655	130,018
1947.....	310,748	99,599
1948.....	376,862	120,789
1949.....	390,446	125,143
1950.....	539,000	172,756
1951 (est.)	670,000	214,744
1952 (est.)	750,000	240,384
1955 (est.)	1,000,000	312,000

no competitive material for ethyl chloride in these two outlets. Ethyl chloride also finds limited use as a refrigerant, an anesthetic, and as a solvent, and thus swell requirements for ethyl chloride.

TEL PLANT CAPACITY	MILLION POUNDS
1952 (est.)	530
1951 (est.)	490
1950	350
1945	296
1944	259
1943	221
1941}	221

The growth in tetrachloro lead plant capacities shown below verifies this statement:

The growth curve of Figure 9 on the consumption of ethylene for ethyl chloride manufacture has been extended to 1962 allowing for the production of ethyl chloride by processes not involving ethylene, e.g., the direct chlorination of ethane. The potential demand for ethylene for ethyl chloride in 1962 is estimated at 350 million pounds.

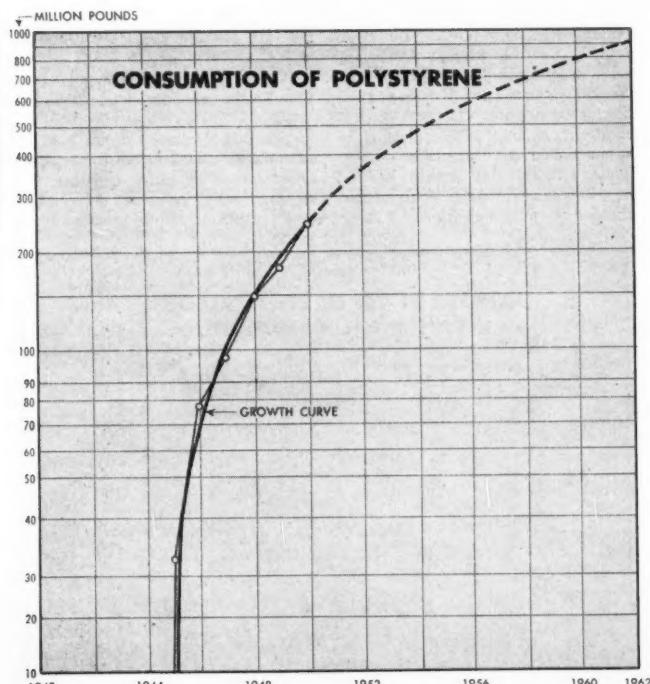


Figure 8

ETHYLENE DICHLORIDE

Ethylene dichloride is usually produced by the vapor or liquid-phase reaction of ethylene and chlorine in the presence of a catalyst. It is also recovered as a by-product in the manufacture of ethylene oxide by the chlorohydrin process.

The U. S. Tariff Commission first reported the production of ethylene dichloride in 1948 when 235.9 million pounds were produced. By 1949 production had risen to 245.9 million pounds. Estimates of the ethylene consumed annually since 1940 in the production of ethylene dichloride⁷ have been plotted in Figure 10.

Ethylene dichloride is used in the manufacture of Thiokol products, antiknock fluids, vinyl chloride and ethylene diamine and is used as a solvent and as an insecticide.

The arbitrary growth curve in Figure 10 shows the consumption of ethylene in the manufacture of ethylene dichloride to be increasing rapidly. Several factors point to continued growth for the next ten years. The use of ethylene dichloride in antiknock fluids will continue to increase as will the demands for specialty solvents such as ethylene diamines.

The greatest opportunity for the growth of the ethylene dichloride market undoubtedly lies in vinyl chloride manufacture. Competition to the use of ethylene dichloride in preparing vinyl chloride is the process involving the addition of hydrogen chloride to acetylene. Again, as in the case of ethylene oxide, the economics of the two processes, particularly in regards to raw material costs, will be the key factor in the future. The growth of the vinyl resins industry has been staggering with volumes consumed rising from 1.2 million pounds in 1939 to over 325 million pounds in 1950.

If vinyl chloride from ethylene dichloride can be made economically attractive, the demands for ethylene in this end-use alone will be greater than the extension to the growth curve in Figure 10. This curve indicates that 200 million pounds of ethylene will be required for ethylene dichloride manufacture in 1962.

ETHYLENE DIBROMIDE

Ethylene dibromide is prepared by the reaction of ethylene and bromide in the presence of a catalyst. Assuming a 90 per cent yield on the reaction, the same as is obtained in the preparation of ethylene dichloride, the estimated 30 million pounds of ethylene consumed in 1950 would make about 180 million pounds of ethylene dibromide.

The major outlet for ethylene dibromide is for use in combination with tetraethyl lead in antiknock formulations. Demands for ethylene dibromide will undoubtedly parallel the growth of tetraethyl lead formulations. It is probable that about 50 million pounds of ethylene will be required in 1962 for ethylene dibromide manufacture.

POLYETHYLENE

It is believed, by many, that polyethylene will soon become the most important plastic in terms of pounds produced. A unique combination of physical properties and low raw material costs would seem to justify this conclusion. Polyethylene is unparalleled in its resistance to low temperatures. Most plastics, even with large amounts of plasticizers, become brittle at low temperatures. But, polyethylene requires no plasticizers. It has the lowest specific gravity (0.92) of any plastic, and this is important to an industry in which most uses are based on a volume requirement and the products are usually sold on a cents-per-pound basis. Thus, polyethylene, although costing more per pound than the heavier vinyls, is still more economical to use¹⁵.

Data on the annual production of polyethylene are not available, but estimates of the amounts of ethylene consumed in its manufacture have been plotted in Figure 11 and an arbitrary growth curve drawn to show the trend of ethylene consumption.

Until 1948, use as electrical insulation remained the most important polyethylene outlet. In 1950, sheeting and film took nearly half of the amount produced.

Polyethylene's properties make it an important new packaging material. Initial difficulties encountered in the use of this film in automatic packaging machinery have been overcome. Flexibility at low temperature has led to the use of this sheeting in the packaging of frozen foods.

In the next ten years, polyethylene will probably be the most rapid growing chemical based on ethylene as a raw material and may eventually be one of the largest volume chemicals from this raw material source.

It is difficult, however, to judge the volume of the ultimate market. The extension of the growth curve in Figure 11 of the consumption of ethylene in polyethylene has been drawn endeavoring to compensate for retarded plant expansion due to high investment requirements. Even with such limitations the curve indicates that

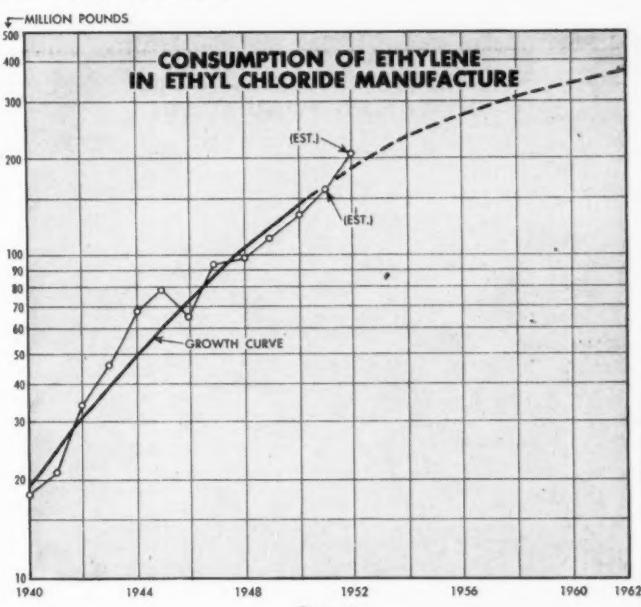


Figure 9

about 550 million pounds of ethylene will be required annually by 1962.

OTHER USES FOR ETHYLENE

Numerous processes use smaller amounts of ethylene in the manufacture of chemicals. Although these uses are widely scattered, it has been estimated that about 73 million pounds of ethylene were consumed in their manufacture in 1950 compared with about 17 million pounds in 1940⁷. The an-

nual estimates available on ethylene consumption for miscellaneous chemicals has been plotted in Figure 12 and an arbitrary growth curve drawn. From a conservative extension to this curve, it is predicted that the consumption of ethylene in miscellaneous chemical uses will be 170 million pounds by 1962. By nature of the scattered uses, the extension does not take into consideration the possibility that some of the materials now being pre-

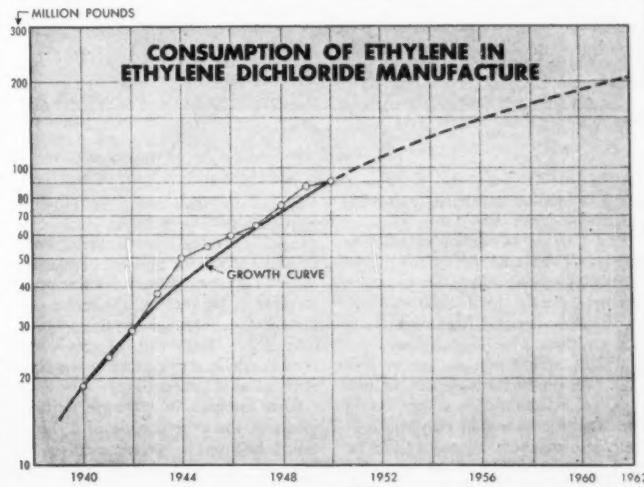


Figure 10

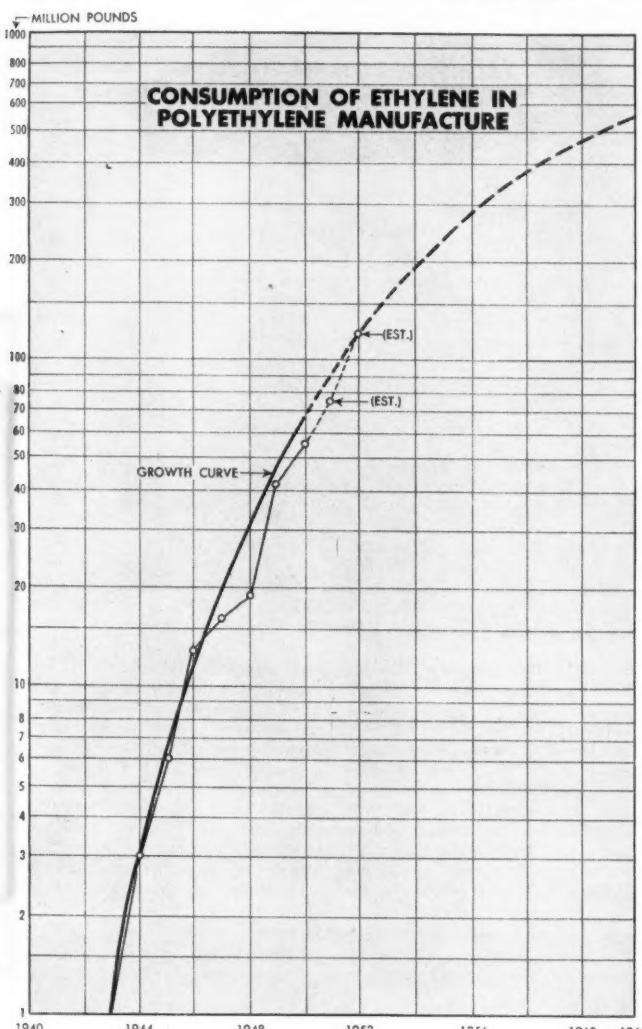


Figure 11

pared in small quantities may develop greatly by 1962. See Table 8.

End Uses: A tabulation of ethylene end-uses (Table 8) reflects numerous interesting facts. First, however, a comment on the total 1950 ethylene requirement derived from end-use of its derivatives. This consumption value of 1,536 million pounds agrees well with the preliminary report of the U. S. Tariff Commission which has indicated the ethane and ethylene consumption for chemical conversion for the year to be 1,834 million pounds¹. Except for the use in polyethylene,

the end-use distribution of ethylene requirements is not due to change appreciably in the next decade. Polyethylene shows the greatest percentage rise and is predicted to have a ten-fold increase in production. The major portion of the potential requirements of ethylene in 1962 will, of course, be used in ethylene oxide and in synthetic ethyl alcohol production.

This increase in ethylene requirements in the next decade of 257 per cent is believed to be conservative and does not, in most cases, reflect the rapid growth of the past ten years.

One reason for this has been mentioned in our discussion; namely, that acetylene will probably be produced commercially and will supplant ethylene as a raw material for some purposes. Allowances have been made for this development. On the other hand, it must be realized that this increase in ethylene requirements has been based solely on commercially available products. It does not take into account the possibility and the probability that many chemicals based on ethylene that are now either in the research or pilot plant stage may make further demands than those accounted for above.

Ethylene-derived chemicals certainly have not reached a peak production but are still in a field that is increasing substantially and continuously.

CHEMICALS VS. FUELS

The petrochemical industry, whether it be the ethylene-derived chemicals part of the industry or the industry in its entirety, by reason of its spectacular progress has a singular allure for the individual, the group, or the already existent company contemplating entry into or expansion of the field. However, there are various caution signs—many of which are obscure—which should be carefully observed. It will be useful and enlightening to examine some of them and to weigh their implications.

The implications apply, of course in greater or lesser degree according to particular circumstances. But, on the basis of a variety of data presently to be shown, it is clear that enthusiasm must be tempered with caution when the critical decisions are being made which will commit a new entrant in the petrochemical field to major investment.

There is no assurance that the enterprise will be profitable; petrochemistry is a young, growing industry full of hazards—it is not a touchstone for profit. The careful, studied approach is especially recommended for the individual or group schooled only in petroleum technology. In the latter field, the traditional thinking is oriented to moving a large volume of products which, by their nature, are quite unlike purified chemicals.

The processing of purified chemicals is governed by severe restrictions—physiological effects, toxicity considerations, safety requirements, international chemistry standards, innumerable legislative controls and so on—and by the demand for an endless

variety of grades of products required by the chemical market. Thus, between the petroleum and the chemical industries there is a fundamental difference of thought.

The distinctions are based, logically enough, on the simple realities of raw materials, processing technology, types of products, and methods of marketing.

Investment Needs: The first caution sign for the newcomer is that of investment requirements. It is true that there would be little difference in investment costs if the chemical plants were as large as refineries. In major refinery equipment, it is recognized by everyone that with increased size the investment cost per barrel thru-put drops significantly. In general an eight-fold increase in size of essential refinery equipment would reduce investment costs per barrel through-put by three.

A review of equipment sizes in petroleum refining and in chemical industries as well as other like comparisons seems to indicate that the average petro-chemical installation is about $\frac{1}{6}$ of the size of the average petroleum refining equipment. On this basis, due to size, the comparative investment requirements per barrel in the petrochemical industry are about three times those in the petroleum industry.

The comparison here presented is based both on some recent information compiled, and studies covering each industry in its entirety. A continuing study by Coqueron and Pogue¹⁷ shows the total overall investment per barrel per day in the petroleum industry to be \$4,280. In the petro-chemical field, a similar study reveals the per barrel per day total overall investment to be approximately \$12,500.

Thus, due chiefly to size, which is governed by product demand, one must think in terms of higher investment costs than are typical of modern refinery equipment. There are some additional and higher investment

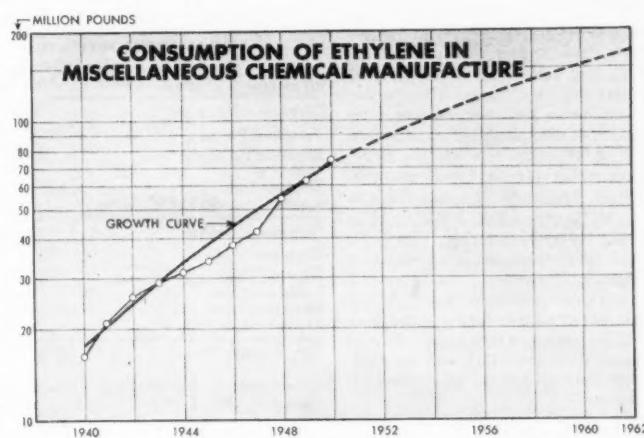


Figure 12

requirements due to the need for special alloy equipment, to the need for special linings in vessels and lines, and to the fact that much of the construction in chemical plants has been inside construction; but these considerations are over-shadowed by the size factor.

Costs and Size: A second caution sign for the potential investor is the relationship of the size of a petro-chemical plant to the cost of the end product. This is a critical relationship as Eugene Ayres¹⁸ has shown in his report on the costs of ethylene production from four-cent propane. The study is based on 1950 construction costs.

As can be seen, it takes enormous processing capacity to keep the cost of manufacturing ethylene on a level with raw material cost. Thus, the newcomer must reckon his competitive position at least partly in terms of plant size. Those who visualize "vest-pocket" units cannot hope to compete favorably with the larger installations now in operation or projected.

The cost per pound of manufacturing ethylene will, of course, be re-

flected in the cost of the end petro-chemical. Further—and here the significance of plant size compounds itself—end product cost might be magnified additionally by the size of those units in which the ethylene and its subsequent products are processed. The capacity-cost relationship, as shown, would hold step-by-step through the processing, from propane (in this instance) to the end petro-chemical. Size may well mean the difference between profit and loss.

Utility Requirements: A third caution sign is that which indicates the utility requirements in petro-chemical processing. Again, a comparison with the petroleum industry is relevant. And again, the needs of the petro-chemical industry are many-fold greater. Some typical comparisons showing the ratio per barrel of charge stock, or feed, follow:

	RATIO OF UTILITY REQUIREMENTS		
	Refineries	Petro-Chemical Plants	
Fuel	1	to	10 to 20
Steam	1	to	3 to 10
Power	1	to	3 to 10
Water	1	to	10 to 100

Table 8
ETHYLENE CONSUMPTION: TODAY AND TOMORROW
1950 1962

Commodity Production	Ethylene Requirement	% Distribution	(Million Pounds)		% Increase	
			1950	1962		
Ethylene Oxide	483	483	31.4	1116	1116	231
Ethyl Alcohol (synthetic)	103.9	495	32.2	230	1110	224
Ethyl Benzene	539	173	11.3	1235	400	231
Ethyl Chloride	350	137	8.9	...	350	255
Ethylene Dichloride	90	5.9	...	200	50	222
Ethylene Dibromide	30	2.0	...	50	1.3	167
Polyethylene	55	55	3.6	550	550	1000
Other	73	4.7	...	170	170	233
Total	1536	100	...	3946	100	257

It would be well for all concerned to keep in mind the final ratio shown—10 to 100 for water—in view of the worsening state of water supply throughout the country. These utility requirements are again, in part a reflection of size and further an indication of the extent to which the petroleum refiner practices heat recovery.

Raw Materials: Another caution sign to be considered is the trend in prices for raw materials. The price trend for natural gas for instance, is definitely upward.

Other raw materials for petrochemicals have had a history of price fluctuation, but prices now appear to have passed their low mark and are definitely moving upward as demand increases.

Location: There are, of course, many other important caution signs which should be scrutinized with a high regard for the hazards implied. Some of them can be mentioned briefly. The geographical location of a petrochemical plant is of paramount importance. Not only the price, as mentioned, but also the availability of raw materials must be considered. The shipping terminus for products has an important bearing on chemical costs and selling prices. Further, the overall problem of transportation bears most importantly on the question of entering the petro-chemical field. This factor becomes very significant with the practice of quoting delivered prices on petrochemicals. The combination of these considerations might well dictate the selection of the petrochemical to be manufactured.

Transportation: A comparison of freight rates for ethylene petrochemicals will reveal an average of more than twice those for petroleum products. A spot comparison makes this clearly evident as shown in Table 9.

The need for thorough study of transportation rates can best be understood by a glance at a population density map, which will reveal the location of the greatest centers of purchasing power. The transportation problem in the petrochemical industry is of substantial magnitude.

The foregoing certainly indicate that there are some difficult obstacles in the marketing of petrochemicals. None, however, are insurmountable. Earlier, mention was made of the fundamental differences in technological thinking between the petroleum and petrochemical industries. An important difference similarly exists with reference to the distribution and marketing of the products. The distinctions again arise from inherent

TABLE 9
RAIL FREIGHT RATES PER HUNDREDWEIGHT
OF SELECTED PETROLEUM PRODUCTS AND CHEMICALS

Distance, miles.	Houston to New York	Houston to Dallas	St. Louis to Chicago	St. Louis to New York
Petroleum Products				
Liquefied Petroleum Gas	\$1.39	\$0.41	\$0.44	\$1.11
Gasoline	1.11	0.38	0.31	0.79
Distillate Fuel	.92	0.38	0.24	0.73
Residual Fuel Oil	.92	0.38	0.24	0.73
Arithmetical Ave.	\$1.08	\$0.39	\$0.30	\$0.84
Chemicals				
Ethylene Oxide	\$2.87	\$0.97	\$0.68	\$1.41
Triethanolamine	2.44	1.08	0.68	1.38
Ethylene Glycol	1.45	0.61	0.42	1.33
Rayon Fiber or Yarn	2.44	1.08	0.93	2.07
Arithmetical Ave.	\$2.30	\$0.93	\$0.68	\$1.55

differences in the products each industry manufactures.

Handling of the various grades of chemicals presents problems quite different from those arising in the handling, say, of motor oils and greases. Cognizance must be taken of the fact that the separation of the pure chemical, and purification to the degree required by the customer for his end use, often result in greater demands on the manufacturing group in the petrochemical industry than in the petroleum industry. Problems relating to distribution—handling, packaging, and so on—are similarly complicated for the products of petrochemistry.

A final caution sign for the potential investor is that referring to research requirements and companion technical service requirements. In the opinion of the writers, no petrochemical company can operate successfully without an able research organization. One critical development can severely handicap a petrochemical company. For example, a common raw material in use today may be displaced tomorrow by an entirely new one. If this new material and/or the process for making it comes from one's own research laboratory, all is well and progress is being made. Should it, however, come from the laboratory of a competitor, the development may well give him a tremendous advantage and effectively reduce the attractiveness of one's venture into this field.

New petrochemicals can give rise to new chemical industries employing new end uses. Such progress makes

new products available in the highly competitive consumer market. Thus, research must be an integrated part of the petrochemical company—an alert laboratory will keep a company abreast of competition and will set the pattern for the company's future. There is ample evidence of the importance of research in both the petroleum and petrochemical industries.

In the petroleum industry the money spent for research is about .85% of total sales. In the chemical, and likewise for the petro-chemical industry, research expenditure amounts to about 2.2% of total sales. In actual expenditures for research, the chemical industry almost equals that of the petroleum industry which is now spending considerable excess of \$100,000,000 annually. The necessity for spending large sums on research constitutes another significant caution sign for the petrochemical investor.

Chemical vs. Petroleum: There is a general opinion voiced that the chemical industry is a most interesting and a most profitable field. Undoubtedly this viewpoint arises because of the rapid growth of the industry, the almost incredible developments resulting from the research efforts therein, and the public demand for these new commodities. There is no doubt of its fascination. The returns, however, are not too far different from the petroleum industry¹⁶, as is evident by examination of Table 10¹⁹.

Certainly the petrochemical field will grow and petroleum, in some of its many forms, will provide more raw

TABLE 10
NET INCOME AND RETURN
FOR CHEMICAL AND PETROLEUM COMPANIES

No. of Companies	1950 Net Income After Taxes	1950 Book Net Assets	% Return on Net Assets	% Margin on Sales
			1950 Net Income After Taxes	1950 Book Net Assets
Chemical Products	65	\$ 742,513,000	\$ 3,484,916,000	21.3
Petroleum Products	45	\$1,730,484,000	\$11,618,635,000	14.9

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materials to the chemical industry than any other source. This overall effort will not have a significant effect on our petroleum reserves or on the major effort of the petroleum companies, namely, to supply fuels and lubricants. Less than 1% of our yearly petroleum production will suffice for today's petrochemicals and will continue to suffice for some time to come.

But mere volume of raw materials consumed is not an adequate basis on which to judge an industry's role and future. A better basis is the value of the industry's products to its customers and to the economy as a whole. By this reasoning the future of the petrochemical industry must certainly be judged to be very bright.

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Table II
CHEMICALS DERIVED FROM ETHYLENE PRODUCTS

PRIMARY	SECONDARY (DERIVATIVES OF PRIMARY PRODUCTS)	TERTIARY (DERIVATIVES OF SECONDARY PRODUCTS)	DERIVATIVES OF TERTIARY PRODUCTS	OTHER DERIVATIVES	USES
Ethylene Oxide	Ethylene Glycol				Antifreeze Formulations
		Ethylene glycol dinitrate			Explosive in low freezing nitroglycerine
		Glyoxal			Dimensional stabilizer for rayon
		1,4-Dioxan			Solvent
		Dioxolan	Di- and hexa-chlorodioxans		Chemical intermediates
		2-Methylidioxolan			Solvent for cellulose esters
		Acetate and phthalate esters			Solvent for cellulose esters
		Copolymer with terephthalic acid ("Dacron" by du Pont)			Plasticizers, solvents
		Condensate with polymeric fatty acid ("Norepol")			Synthetic fiber
		Mono- and di-ethers ("Cellosolves" by Carbide and Carbon, e.g., Butyl "Cellosolve", Diethyl "Cellosolve")			Synthetic elastomer
			Fatty acid esters of monoethers ("Cellosolve" acetates by Carbide and Carbon)		Solvents, e.g., paints trade
		Diethylene glycol	Mono- and di-ethers ("Carbitol" by Carbide and Carbon, e.g. Methyl "Carbitol" Diethyl "Carbitol")		Solvent—plasticizers
					Solvents, e.g., paints trade
			Fatty acid esters of mono- ethers ("Carbitol" Acetates by Carbide and Carbon)		Solvent—plasticizers
					Solvent—plasticizers
			Fatty acid esters a) diethylene glycol diacetate		Solvent
			b) diethylene glycol monolaurate or monostearate		Emulsifiers
		Triethylene glycol			Solvent — plasticizers, hy- draulic brake fluid compo- nent
			Mono- and di-ethers (Ethoxytriglycerol)		Solvent
					Solvent
			Fatty acid esters of mono- ethers (methoxytriglycerol acetate)		Solvent
			Mono- or di-acid esters (tri- ethylene glycol di- <i>i</i> -ethylhexoate)		Plasticizer
					Solvent—plasticizer
			Mono- and di-ethers (Dimethoxytetraglycol)		Solvent
					Plasticizers, dispersants, lu- bricants, binders

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PRIMARY	SECONDARY (DERIVATIVES OF PRIMARY PRODUCTS)	TERTIARY (DERIVATIVES OF SECONDARY PRODUCTS)	DERIVATIVES OF TERTIARY PRODUCTS	OTHER DERIVATIVES	PRODUCTS	
					USES	
			Monoethers (from alcohols, phenols and mercaptans) (Methoxypolyethylene glycol series by Carbide and Carbon)		Intermediates for detergents	
			"Brij" products by Atlas Powder (laurylalcohol)		Emulsifiers	
			"Cerfax 1300" by E. F. Houghton (alcohol)		Detergent, wetting agent	
			"Antara 400" series by Gen'l. Aniline & Film (alkylphenol)		Emulsifiers	
			"Antarox A" series by Gen'l. Aniline & Film (oleyl alcohol)		Emulsifiers, detergents, wetting agents	
			"Antarox D 100" series by Gen'l. Aniline & Film (oleyl alcohol)		Emulsifiers	
			"Glim" by B. T. Babbitt (phenol)		Detergent	
			"Nonic 918" by Sherples Chem. (mercaptan)		Detergent, wetting agents	
			"Sterox" series by Monsanto Chem. Co.)		Detergents	
			Fatty acid esters of mono-ethanolamine (Emulfor AG, ELA" by Gen'l. Aniline & Film "Tween" series by Atlas Powder Co.)		Detergents, emulsifiers and dispersants	
			Mono- and di-acid esters (polyethylene glycol dil-ethylhexoate)		Low-temperature plasticizer	
			"Noniso" series by Abrose Chemical Co. (lauryl, oleic and stearic acids)		Emulsifiers	
			"Nopolcol" series by Nopco Chem. Co. (fatty acids)		Emulsifiers	
			"Advawets" by Advance Solvents Co.		Emulsifiers	
			"Antarox B" series by Gen'l. Aniline & Film (oleic and ricinoleic acids)		Emulsifiers	
			"Energetic" by Armour & Co.		Detergent, wetting agent	
			"Myri" by Atlas Powder (stearic acid)		Emulsifier	
			"Peg 42" by Glyco Products (stearic acid)		Emulsifier	
			"Renex 48, 98" by Atlas Powder (mixed fatty and tall acids)		Detergent, wetting agent	
			Alkyloleamines		Solvent, gas scrubber to remove acidic constituents	
	Monoethanolamine				Explosive	
			2-Nitroaminoethyl nitrate		Accelerator for rubber vulcanization	
			Mercaptothiazoline			
			Ethylene imine		Polymers in paper coatings and textile treatment	
			Fatty acid amides (derived mainly from cocoanut oil)		Detergents	
			Sodium salts of fatty acid amides		Detergents	
			Salts of alkyl aryl sulfonates		Detergents	
	Diethanolamine				Gas scrubber to remove acidic constituents	
			Fatty acid amides "Ninol" series by Ninol Laboratories		Detergents, textile lubricants	
			"Amine ES" by Carbide and Carbon (stearic acid)		Emulsifier	
			Morpholine		Solvent, corrosion inhibitor	
			Morpholinoethyl alcohol		Intermediate for pharmaceuticals and rubber chemicals	
			Diodecylethanolamine		Detergent intermediate	
	Triethanolamine				Corrosion inhibitor	
			Tetraethanolammonium hydroxide		Strong base	
			Triethanolamine alkyl sulfate ("Drene" by Procter and Gamble)		Shampoo	
			"Dupanol WAT" by du Pont		Detergent	
			"Emcol 415C, 5100" by Emulsol Corp.)		Detergent	
			Fatty acid amides		Emulsifiers in waxes	
			Salts of 2,4-dichlorophenoxyacetic acid		Weed killer	
	Ethylene Cyanhydrin				Intermediate	
			Acrylonitrile		Intermediate	
			Polymers ("Orlon" by du Pont)		Synthetic fiber	
			Copolymers with: Butadiene ("Hycar" by B. F. Goodrich)		Buna N synthetic rubber	

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PRODUCTS

PRIMARY	SECONDARY (DERIVATIVES OF PRIMARY PRODUCTS)	TERTIARY (DERIVATIVES OF SECONDARY PRODUCTS)	DERIVATIVES OF TERTIARY PRODUCTS	OTHER DERIVATIVES	USES
			"Paracril" by U. S. Rubber	Buna N synthetic rubber	
			"Chemigum" by Goodyear Tire and Rubber	Buna N synthetic rubber	
			"Butaprene" by Firestone Tire and Rubber	Buna N synthetic rubber	
		Vinyl Chloride ("Dyne" by Carbide and Carbon)	Synthetic fiber		
		Vinyl Acetate ("Acrlan" by Chemstrand)	Synthetic fiber		
		Vinyldene Chloride ("Saran F 190" by Dow Chemical)	Plastic		
		2-Chlorobutadiene ("Neoprene ILS")	Synthetic rubber		
	Acrylic acid			Chemical intermediate	
	Alkyl Acrylates				
		Polymers		Oil additives, adhesives	
			"Lucite" by du Pont "Plexiglas" by Rohm and Haas	Plastics	
	Monothioethylene glycol			Intermediate	
	Methionine			Growth accessory substance	
	Thiodiglycol (di-2-hydroxyethyl sulfide) ("Kromax" solvent by Carbide and Carbon)			Solvent in printing process	
		"Mustard Gas" (di-2-chloroethyl sulfide)			
	Tri-2-chloroethyl phosphate ("Flexol" Plasticizer 3 CF by Carbide and Carbon)			Plasticizer	
	Dioxalans (also from ethylene glycol)			Solvents	
	Ethylene sulfide			Treatment of textile fibers, chemical intermediate	
Ethyl Alcohol				Solvent	
	Butadiene				
	Polymers	"PB" or "Polybutadiene" by Phillips Pet. Co.		Synthetic rubber	
		Co-Polymer with: Styrene		GR-S type synthetic rubber	
		Acrylonitrile		Buna N type synthetic rubber	
		Adiponitrile (1,4-dicyanobutane)		Intermediate for nylon mfg.	
		Butadiene sulfones ("Sulfolanes" by Shell Devel. Co.)		Selective solvents	
	Diethyl ether			Solvent, anesthetic, chemical intermediate	
	Ethyl amines (mono-, di- and tri-)			Chemical intermediates	
	Ethyl chloride			Refrigerant, anesthetic	
		Ethyl cellulose		Plastic, protective coatings	
		Tetraethyl lead		Anti-knock compound	
	Acetaldehyde			Chemical intermediates, solvent, protective coating intermediate	
		Acetic acid or anhydride		Rayon, plastics, chemical intermediate	
		n-Butanol		Solvent	
		Ethyl acetate		Solvent	
	Chloral (Trichloroacetaldehyde)				
		D.D.T. (p,p-dichlorophenyl trichloroethane)		Insecticide	
	Numerous esters with acids			Solvents, chemical intermediates, etc.	
Ethyl Benzene					
	Styrene				
		Polymers		Plastics	
		"Lustron" by Monsanto Chem. Co. "Styron" by Dow Chemical			
		Copolymer with p-Divinylbenzene		Ion-exchange resin	
		"Amberlite," "Ionac," Dowex" Drying oils		Styreneated oils	

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PRODUCTS

PRIMARY	SECONDARY DERIVATIVES OF PRIMARY PRODUCTS	TERTIAL DERIVATIVES OF SECONDARY PRODUCTS	DERIVATIVES OF TERTIAL PRODUCTS	OTHER DERIVATIVES	USES
	Butadiene				GR-Synthetic rubber, plastics
	Isobutylene ("S Polymer" by Enjay Co.)				Plastic films and coatings
Polyethylene ("Polythene")					Plastic for electric wire insulation, films, paper coating
Ethylene Dichloride	Ethylene diamine				Solvent and chemical intermediate
	Diethylene triamine				Chemical intermediate
	Triethylene tetramine				Chemical intermediate
	Succinonitrile				
	Copolymer with sodium polysulfides ("Thikol")				Synthetic elastomers
	Perchloroethylene (tetrachloroethylene)				Solvent, chemical intermediate
	Hexachloroethane				Plasticizer
	Trichloroethylene				Dry-cleaning solvent, degreaser
	Hexachlorobutadiene				Transformer oil additive
	1,1,2-Trichloroethane				Solvent
	1,1,1,2-Tetrachloroethane				Solvent
	Trichloroethylene				(see above)
	Pentachloroethane				Solvent
	Vinyladine Chloride			Perchloroethylene	(see above)
		1,1,1-trichloroethane			Solvent
		Polymers			
		Polyvinylidene chloride			Plastics
		Copolymers with vinyl chloride "Saran" by Dow Chemical Co. "Velon" by Firestone Plastics Co.)			Plastics
Vinyl chloride					
	1,1,2-trichloroethane				Solvent
	Polymer				
	"Gron" by B. F. Goodrich Chem. Co. "Marvinol" by U. S. Rubber Co. "Tyson" by U. S. Stoneware Co. "Vynlite" by Bakelite Co.				Resins and Plastics
	Copolymer with Vinyl acetate "Vynite" series V resin by Bakelite Co.				Plastic
	"Vynon" by Bakelite Co.				Synthetic fiber
	Acrylonitrile "Vynon N" by Bakelite Co.				Synthetic fiber
	"Saran" by Dow Chemical Co.				Plastic
Methyl ethyl benzene					
	Vinyl toluene				Replacement for styrene
	Copolymer with butadiene				GR-S type synthetic rubber
Propionaldehyde	Propionic acid and anhydride				Chemical intermediate for rubber chemicals, resin, etc.
	Pentaglycerol				Chemical intermediate solvent-plasticizer in resins
Ethylene dibromide					Component of anti-knock fluid, solvent, chemical intermediate
1,2-Dinitroethane					Chemical intermediate
2,2-Dimethylbutane 2,3-Dimethylbutane					Components of Aviation gas
3-Methyl pentane Ethyl cyclohexane					Components of Aviation gas
Di-2-chloroethyl sulfide ("Mustard gas")					Poison gas
Trichloroethylene					Dry-cleaning solvent degreaser
Perchloroethylene (tetrachloroethylene)					Solvent, chemical intermediate

SPECIALTIES . . .

Like a Duck's Back

Water-repellent finishes for masonry are the latest formulated products to "go silicones". They permit masonry to "breathe" while keeping moisture out; reduce staining, spalling and efflorescence; are durable.

Silicone producers are bringing out special resins for this application, envision a large potential market for compounders.

The trade that supplies water repellent products for masonry—concrete, brick, cinder block, plaster—has followed car and furniture polish formulators along the silicone trail. Products bearing the so-called magic silicone legend are springing up in increasing numbers, and silicone producers are bringing out new materials to meet the specific requirements for such applications.

Dow Corning, for example, has just come up with its latest in this line—resin XR-129G, for which it claims greater water repellency and quicker cure than any comparable resin. It's the company's latest step in five years' work in the field.

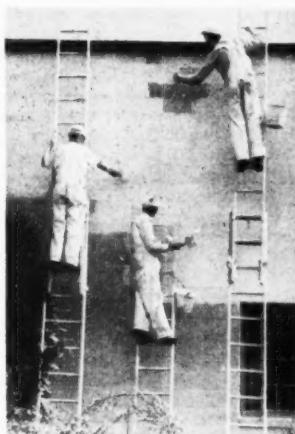
But General Electric has a new one too—SR-53. And Linde Air Products, the other silicone maker wooing formulators of water repellents, has another entry bearing a numerical designation—C-25. This has been under test for some time, was introduced commercially late last year.

Strictly Basic: None of these chemical producers puts out a formulated product itself; in each case the resin is sold as a solution to formulators who cut it with appropriate solvents for packaging and sale as end-use products.

Dow Corning's XR-129G is formulated as a 3-5% silicone solution by merely mixing the concentrate in a solvent which has a flash point of 81-95F, a boiling range of 275-350F, and a kauri butanol number in excess of 50. Working with Linde's product is also a simple matter; it is cut 4:1 with petroleum spirits. GE's SR-53, a 10% solution, is cut to 2% with similar solvents for use.

All of the materials can be applied by spray, brush or dipping, where possible. They cure rapidly, and give good coverage, although it is hard to put a figure on how good that is, for it varies with the surface. None is recommended for water-proofing masonry below the ground — where hydrostatic pressure is a factor.

Applied to above-ground masonry, however, the finishes impart an in-



MASONRY WALL: Swishing with silicones now.

visible coating that not only resists moisture penetration, but permits air to pass through the pores of the building material. Dirt does not accumulate in the interstices of the concrete, but is washed off by rains. Masonry is rendered resistant to staining and to efflorescence; also spalling (and subsequent soaking of interior walls) following freezing of wet walls is eliminated.

The new finishes are a marked improvement over older treatments—cement-based paints and formulations based on paraffin or stearates—in that they are invisible and durable, in addition to the "breathing" water repellency combination. The older types did not stand up, and they either changed the color of the masonry or presented a shiny appearance.

Mixed Views: No one is sure how big a market the new finishes can hope to develop. Older products were not very popular, for claims made by producers often did not jibe with results obtained after use. They were used mainly on public buildings and institutions, and by some contractors in building. Small-package sales how-

ever, have never been very great.

With the improved materials, it is expected not only that industrial and institutional consumers will increase, but also that home owners will become conscious of their advantages. The trend toward greater use of concrete block and asbestos shingles in small home construction is responsible for some of this optimism.

Some formulators have done an aggressive selling job—the pitch is that a new home can be kept looking new with an early application of such a product. Sales, however, are still principally to building contractors and the like, although the consumer field is growing. While some producers think this can be expanded steadily—if not as dramatically as was the case with silicones in polishes—others feel that a big educational program is a must before real headway can be made.

But as with silicone polishes, smaller formulators seem to be taking the lead. If enough of them do a good missionary job, big finishes makers (they all are experimenting) will grab a ring on the band wagon.

Curb on Chlordane

USDA has revised labeling rules for chlordane, limiting use of household chlordane insecticides to "spot" applications for control of roaches, ants and a few other pests. New regulation won't affect products packaged prior to September 15 until September 15, 1952.

Products packaged after the September 15 cut-off date, however, do come under Interpretation 19, Part 162, Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act, as the new ruling is officially called. And since it prohibits directions for household use of mist sprays containing chlordane, it effectively bars further manufacture of chlordane aerosols.

Now can manufacturers recommend chlordane-containing formulations for the general treatment of large areas, or for the treatment of furniture and clothing.

Year's Grace: The object, of course, in granting a year's period of grace before the effective date for products already manufactured, is to give producers an opportunity to dispose of stocks that have been prepared in accordance with the old regulations.

These products generally fall into three classes: (a) kerosene solutions which may or may not contain other

SPECIALTIES

chlorinated hydrocarbon insecticides and certain paralytic agents in addition to chlordane; (b) water emulsions which ordinarily do not contain other insecticides and are used undiluted, or emulsifiable concentrates to be used after suitable dilution with water; and (c) dry powder formulations based on talc, pyrophyllite or other diluents which occasionally contain small quantities of other insecticides.

Formulation requirements call for sufficient chlordane, alone or in combination with such toxicants as DDT, to be fully effective as residual insecticides against insects listed on the label—now limited to roaches, water-bugs, silverfish, ants, carpet beetles or brown dog ticks in premises. Chlordane content of petroleum distillate spray formulations cannot exceed 2.5% and if other insecticides are used which have acute or poisonous characteristics, the amount of chlordane must be reduced in proper proportion. With dry powder formulations, the upper limit on chlordane is 50% by weight, and if other toxicants with acute or chronic poisoning characteristics are present, the percentage must also be reduced proportionately.

While the changes in the regulations have been made by the USDA, the action came about partly through prompting from the Food and Drug Administration. For some time this agency has evinced antipathy toward chlordane in household insecticides because of its demonstrated toxicity.

The Glow That Sells

Time was when a pigment exhibited only its own color, but now pigments with a color-and-a-half's worth of saturation are making spectacular inroads in the sale of specialty paints, clothing for extroverts, and sales and display materials.

The glowing pigments, which have really only hit their stride in the past year and a half, are of three main types:

Phosphorescent Pigments: These are the pigments which, after being exposed to light, glow for from 2 to 12 hours. Principal uses: safety devices, light switches, night lamps.

Fluorescent Pigments: These pigments, like the phosphorescent ones, will glow in the dark, but only when excited by ultraviolet light. When the light source is turned off, they go off, too. Principal uses: displays and billboards. In a technical sense, the far-and-away biggest use here would be in the phosphors in fluorescent lights.

Daylight Fluorescent Pigments: In

addition to exhibiting a "normal" color, these absorb the ultraviolet light present in daylight and radiate it as a visible color which enhances the saturation of the "normal" color. First use of these came in swim suits, but they are now applied to socks, hats and most in-between garments. Surprisingly, Sunday Tarzans haven't been the only purchasers. In the past summer's soft goods slump, about the only lines which sold well were those using these dyes.*

Another big use for daylight fluorescents: optical bleaches, where the intense blue fluorescence is used in combating the yellowish color of washed whitegoods. (CW, July 14).

The daylight fluorescents are organic or organometallic dyes, unlike the non-daylight fluorescents and the phosphorescents, which are primarily zinc and magnesium oxides and calcium, strontium, zinc and cadmium sulfides.

Pigments made by Switzer Brothers, Cleveland, are organocadmium compounds. The firm licenses fabric manufacture (under the Colofore trade mark) and pigments for printing, silk screen work and paints (under the Day-Glo name).

The flavine group of dyes, produced in this country by General Dyestuffs, has also been at the front of the expansion, but Calco Division, Ciba, Du Pont and Geigy can't be counted out in production of such dyes as the eosine, rhodamine, stilbene and imidazolone families.

A definite drawback to the daylight fluorescents is that they fade. When used outdoors on billboards, useful life is considered only 30 days. If they are protected from sun and weather, their life can be definitely increased.

Inorganic Pigments: Main producer of the non-daylight fluorescents and the phosphorescents is New Jersey Zinc, which markets under the Horse Head name. (Electrical companies' production is captive.) Others who sell the pigments or paints include the Canadian Radium and Uranium Corp. (distributed by James Norris of New York under the Glo-n-Glo name), R. I. Laboratories of West Warwick, Conn., and Lawter Chemical of Chicago.

Main advantage of these pigments is that they last from three to six months. Also, in display work, they can be used in conjunction with

* Indication of the tightness of these compounds came when the Chemicals Procurement Co. was asked to obtain a pound of a fluorescent flavine dye for laboratory experimentation on possible pharmaceutical properties. Total available to the company's pharmaceutical house customer: one ounce.

dinary paints to provide a double message with change in lights.

Price Aspect: On costs, the pigments are definitely on the expensive side. This precludes use replacing ordinary pigments except where the special qualities are necessary. Luminescent pigments generally cost between \$1.75 and \$5 per pound; and since two to three pounds are needed for each gallon of paint, the price is four to five times that of ordinary paints.

The present uses are novelties for the most part, but if manufacturers have their way, they will be finding more functional uses for the pigments. Wall finishes for rooms used in subdued light—in theaters or in homes in rooms where television is viewed—have been suggested. Shortages of chrome and other trim for automobiles and other durables also offers possibilities for application of the finishes.

Industrial Detergent: A new industrial detergent, claimed by its manufacturer, Wyandotte Chemicals Corp. (Wyandotte, Mich.), to be the first such promoted product, is now being produced in commercial quantities. It is called Kreelon CD, is a mixture of Wyandotte's Kreelon, an alkyl aryl sulfonate synthetic detergent, and its Carbose brand of sodium carboxymethylcellulose.

It will be sold to the laundry and textile fields for use in such operations as commercial cleaning, kier boiling, and after-soaping. Among advantages claimed for the new product: improved soil removal and whiteness retention in cleaning and processing cottons; elimination of the need for storing both detergent and detergent promoter.

Residue Tolerances: The tentative order setting proposed residue tolerances of agricultural chemicals permitted on fresh fruits and vegetables is still some months off. Commissioner of the Food & Drug Administration Crawford has advised the National Agricultural Chemicals Association that the record of the FDA hearings on the matter—some 25,000 pages of testimony and exhibits—is being studied in the General Counsel's Office, and that he hopes to issue a tentative order within a few months.

Niagara Expansion: Niagara Chemical Division of Food Machinery & Chemical Corp., will build a 12,000 sq. ft. plant at Yakima, Wash., its first in the Pacific Northwest, for mixing insecticides and fungicides. Facilities for producing weed killers and fertilizers are expected to be added later.



THE FIRST 84 YEARS
ARE THE *easiest...*

In 1867, Mallinckrodt opened its doors for business, the first manufacturer of fine chemicals between Philadelphia and the West Coast. The changes that have taken place since then in the scientific world have demanded more and greater skill, controls and equipment in the manufacture of fine chemicals. Our chemists and engineers have continuously met these new demands and in many cases have led the field.

But the changes of these past 84 years are likely to be dwarfed in this era of atomic energy. Our most challenging tasks still lie ahead. We are making the necessary preparations to be ready for them.

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@ 25°C:	0.855 g/m 1, or 7.13 lbs. gal.
Coefficient of Cubical Expansion:	0.000 46 per 1°F 0.000 83 per 1°C.
Distillation Range @ 25 mm of Mercury:	220°C - 225°C
Melting Point:	19°C, approx.
Heat of Fusion:	40 cal/g, approx.
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@ 25°C:	1.442
Dielectric Constant @ 30°C:	3.12
Odor:	Practically odorless
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Solubility @ 25°C:	Approximately 0.2 ml Butyl Stearate soluble in 100 ml water. Approximately 0.03 ml water soluble in 100 ml Butyl Stearate

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RESEARCH . . .

Missing Link for Europe

ECA-sponsored survey of West German research resources may mean more European applied research institutes to bridge the gap between pure and industrial research, hasten recovery.

At least one U. S. research foundation—Battelle Institute—is convinced of the need, is establishing an international industrial research institute in Europe this fall.

Greater industrial productivity is the non-Soviet world's best means of insuring its defense and promoting its economic welfare. And European nations, along with the Economic Cooperation Administration, are convinced that the key factor is rapid industrial application of scientific findings.

Applied research institutes and laboratories such as exist in this country seem to be the best bridges between scientists concerned with "pure" scientific discoveries and production men whose job is putting such results to practical use.

For ECA has just had an American team of applied research authorities survey West Germany's industrial research and development needs to see whether U.S.-style research institutes should be established. A German scientist, himself connected with the Organization for European Economic Cooperation (OEEC), requested the survey after visiting some 30 American research institutions. He felt that research facilities equipped, staffed and organized along similar lines could put the needed spark in German industry.

The trouble with Germany is that universities are the leaders in research, and they concentrate on theoretical matters, giving little attention to industrial applications of their results. And while large companies maintain laboratory facilities, they deal principally with production and market development problems. This leaves the small and medium companies, necessarily having limited (if any) funds for research programs, with no facilities for solving technical problems. Such a situation is in sharp contrast to that obtaining in this country with its many industry-minded universities, Government laboratories, trade association research programs and industrial research institutes.

Who's Who: ECA appropriated \$41,000 for the mission, rounded up a seven-man group headed by South-

west Research Institute's president, Harold A. Vagtborg (see cover), and boasting (in addition to SRI, also represented by Calvin O. Williams, executive secretary of its international division) scientists from Stanford Research Institute (Jesse E. Hobson, director), Battelle Memorial Institute (Robert R. Adams, assistant to the director) and Armour Research Foundation (William A. Casler, assistant director of research) as well as consultants Hugh G. Buhrman and Maurice Holland.

The team spent about three weeks appraising not only Germany's available facilities and its research needs, but such important considerations as the attitude of business and industry toward applied industrial research and the interest of government officials in such a program. It also had as a goal the selection of industries that could be stimulated by such means. If, in the group's judgment, one or more research institutes were deemed desirable, the mission was to propose the form it should take, including organization, functions, policies, etc. in a report.

Vagtborg made a tentative report to ECA early this month, but until ECA gets and digests the complete report, there will be no decision made on implementing the mission's suggestions. Moreover, the group stopped in Paris on the way back and discussed with OEEC officials similar surveys for Austria, Belgium, France, Italy, The Netherlands and Norway. But no decision has been made yet on these projects, though they stand a good chance of approval.

Concrete Evidence: One of the U. S. research institutes taking part in the survey—Battelle—is convinced that Europe can use applied research to realize its full industrial potential. For the past three years it has been studying the organization of science and industry on the Continent; this fall it is establishing Battelle international, a new international re-



MELLON INSTITUTE: Similar lab-to-plant bridges abroad.

search institute which will maintain laboratories and offices in several Western European countries. It has just sent a three-man team abroad to negotiate lab sites and to recruit a staff, as well as to launch research projects in laboratories of established organizations.

The institute will operate, as does the parent U. S. organization, on a non-profit basis, will have as its province applied chemistry and physics, metallurgy, fuels, ceramics, electronics, mechanics, engineering sciences and agriculture.

First year's operating costs are expected to be over \$1.5 million. Most of this will come from Battelle funds and contributions by American firms which have sponsored research at the Battelle's Columbus, Ohio labs. But later, European industries are expected to support an expanded program as they benefit from the accelerated industrial progress such institutes have made possible in this country.

Chemical Machining

Ultraviolet light, heat and hydrofluoric acid are the only "tools" needed to precision-machine a new kind of glass into intricate patterns of any shape and depth.

The new glass, a product of Corning Glass Works, is a special type of photosensitive opal glass, to which the company has adapted the new "chemical machining" process to produce without mechanical tools lace-like patterns previously considered impossible in glass.

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F-12B



McGRAW-HILL PUBLICATIONS

RESEARCH

the glass by means of an ordinary photographic negative and ultraviolet light. Heating at 1200 F for about two hours develops the design, at this stage a milk-white image in the otherwise transparent glass.

Then the glass is immersed in a solution of hydrofluoric acid until the white areas, less resistant to hydrofluoric acid than the unexposed portions, are eaten through and removed, leaving the remaining unexposed glass in the form of the original pattern.

Controlled Etching: The depth of acid penetration in the glass can be accurately controlled from shallow etching to complete erosion by varying the length and intensity of light exposure through the photographic negative. Thus, sculptured figures or contoured shapes can be produced by using a continuous-tone negative with proper degrees of shading.

Because of the absence of mechanical stress throughout the process, complex patterns that only a skilled craftsman could produce at the expense of much time can be simultaneously reproduced in any number and with photographic accuracy by the new method. It's especially suited to perforating holes of any shape having diameters of only a few thousandths of an inch and numbering up to several thousands per square inch.

Corning Glass has just begun to explore the potential of the new glass, but it appears that it will find first application in the field of electronics. E.g., in making "printed" electrical circuits for electronic instruments in one operation, a sheet of glass can be cut into multiple pieces, each of proper shape and size, and each having identically etched circuit patterns and holes for fastening to a chassis. The pattern so photo-engraved in each piece of glass is filled with conducting metals to form an electrical circuit of high precision and durability.

Crystalline Enzymes: Hyaluronidase and trypsin are among the crystalline enzymes that have just been added to Mann Fine Chemicals, Inc.'s (New York) roster of research chemicals. Trypsin is of interest because of its ability to proteolyze dead tissue in suppurating lesions, is also available to registered hospitals from Armour Laboratories (Chicago), which produces it in highly purified form under its brand name Tryptar.

Paper Progress: Scott Paper Co. has recently installed a baby paper machine in its newly-enlarged laboratory at Chester, Pa. Researchers will use it to check laboratory experiments.

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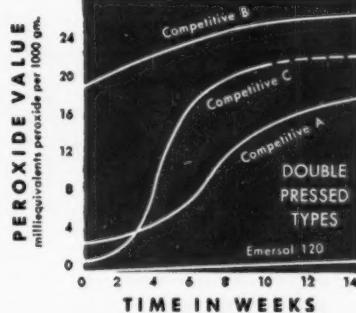
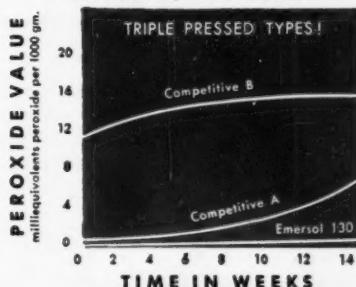
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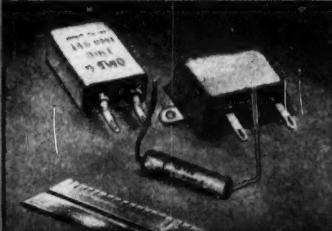
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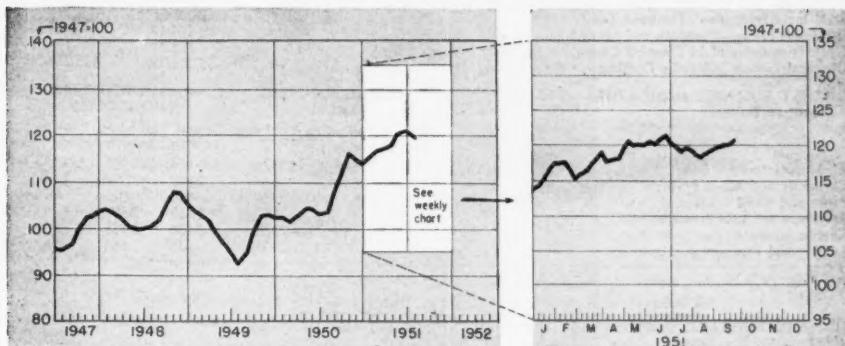
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CHEMICAL MARKETS . . .



CW Index of Chemical Output—Basis: Total Man-Hours Worked in Selected Chemical Industries

The expected autumn upturn in chemical demand is underway, but progressing more slowly than some had hoped. However, it's still a bit early to tell how high demand will go.

But chemical makers are preparing now for expected sales by stepping up production. The CW output index has reached 121 (1947=100), only a shade under the all-time peak last spring. The index has been on the rise for the past three weeks, and a new output record is imminent.

With the return of fall, the resale market is also getting more active after the summer lull. Few in this speculative business, however, see a return to the lush days of late 1950 and early 1951, when resale quotations on some critically-short chemicals often quadrupled the manufacturer's price.

The present situation is no longer like that, but ascending prices bear witness to some new supply pinches. Only three weeks ago, resale phthalic anhydride was 55¢ a pound, titanium dioxide was 30¢ and phenol was 35¢. Today a pound of each costs more: 5¢ for phthalic, 5¢ for the pigment, and 6¢ for phenol.

Meanwhile producers of these items, enmeshed by OPS regulations, still retain the 20¢ a pound selling price.

Both phthalic anhydride and phenol will be getting tighter before the end of 1951. And the shortage of phthalic is slated to worsen in 1952, as the supply of naphthalene raw material lags behind the booming demand for its product. Not so with phenol: More benzene from petroleum should insure plenty of this phenol raw material next year.

Almost every buyer of spot caustic can get it from the manufacturer today. As more has become available, the reseller's margin has dwindled to the point where caustic is no longer a profitable item to handle.

Manufacturers are doing a brisk business both here and abroad at 3-3½¢ a pound. Resellers reminisce of the days last spring, when they could get 10¢ a pound for the same product with no trouble.

MARKET LETTER

MARKET LETTER

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Chemical Industries Output Index (1947-100)	121.5	121.0	114.3
Bituminous Coal Production (Daily Average, 1000 Tons)	1,810.0	1,847.0	1,897.0
Steel Ingot Production (Thousands Tons)	2,041.0	2,023.0	1,942.0
Wholesale Prices—Chemicals and Allied Products (1926-100)	140.4	140.2	128.6
Stock Price Index of 14 Chemical Companies (Standard & Poor's Corp.)	256.5	258.2	190.6
Chemical Process Industries Construction Awards (Eng. News-Record)	\$7,812,000	\$5,254,000	\$35,220,000

MONTHLY BUSINESS INDICATORS—TRADE (Million Dollars)

	MANUFACTURERS' SALES			MANUFACTURERS' INVENTORIES		
	Latest Month	Preceding Month	Year Ago	Latest Month	Preceding Month	Year Ago
All Manufacturing	\$21,615	\$22,758	\$20,269	\$40,406	\$39,957	\$29,830
Chemicals and Allied Products	1,679	1,684	1,442	2,852	2,756	2,041
Paper and Allied Products	632	678	528	951	925	695
Petroleum and Coal Products	1,892	1,863	1,738	2,437	2,353	2,046
Textile Products	1,241	1,303	1,206	3,506	3,489	2,274
Leather and Products	302	292	349	645	684	568

A sharp pickup in demand for most plastics is boosting calls for plasticizers. Fortunately, tricresyl phosphate and butyl phthalate are now in a relatively good supply position. Supply and demand for dioctyl phthalate (DOP) are in balance, but the price of one major producer was boosted 2½¢ a pound as a result of filing under CPR-22.

The price of Rohm & Haas' capryl alcohol has been cut for the second time in two weeks. The new price of 17½¢ is a 2¢ drop from the previous level; the price two weeks ago was 28½¢. Behind the changes: increasing demand for sebacic acid, co-product with capryl in the manufacture from castor oil. With more sebacic needed than ever before, capryl alcohol supplies may become overly abundant.

At yet, other producers have not tried to match Rohm & Haas in the new price policy. But at the new low price, Rohm & Haas hopes to develop new capryl alcohol markets. Good bet: plasticizers.

Other reductions are expected soon in cortisone-like products. A 25% cut in ACTH price by Armour is slated to take effect this week, and other producers aiming for a similar market will soon follow. Reason: expanding production, improvement in manufacturing processes, keener competition.

A double shortage, niacinamide and pyridine, will be eased early in 1952. Nепара Chemical Co. will be making niacinamide by a new process based on acetaldehyde. Significance: nepara has long bought a third of total U.S. pyridine output.

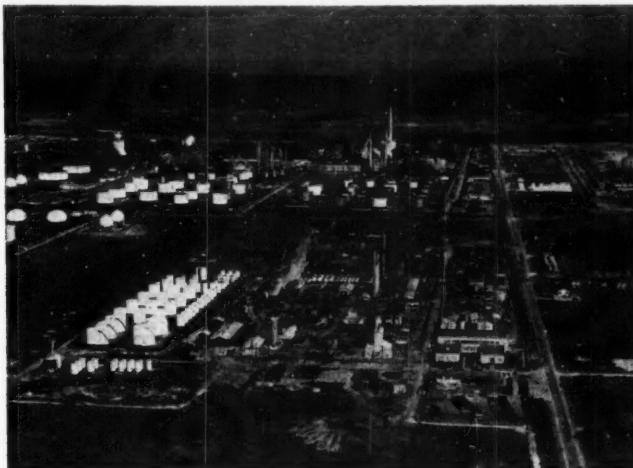
Less essential users of sulfur will find NPA getting stricter during the next year. Production will be some 100 thousand tons short of demand in the last quarter of this year. Hence, NPA has ordered an inventory cutback by non-priority customers from 90 to 25 days.

Lack of selenium, sulfur's chemical relative, is due to rising demand coupled with declining output. The million pound production goal set by NPA won't be met because of work stoppages in copper refining, in which selenium is a by-product. Those who need selenium for rectifiers, chemicals, and special glass can expect to have a difficult time.

SELECTED CHEMICAL MARKET PRICE CHANGES—Week Ending September 24, 1951

UP	Change	New Price	DOWN	Change	New Price
Copra, ton. Pac.	\$10.00	\$190.00	Quicksilver, 76 lb. flask	\$5.00	\$210.00
Capryl Alcohol, tons	.02	.175	Carnauba Wax, No. 1 Yellow	.02	1.22

All prices per lb. unless quantity is stated.



ISOPROPYL ALCOHOL MANUFACTURE: Some will get it for less.

Only One Came Down

Lower isopropyl alcohol price from one major producer is outcome of filing under OPS order CPR-22.

Other isopropyl producers find demand is strong, have no intention of meeting price cut for the present.

Maintaining the price differential depends on activity in rayon, paint, and on the synthetic rubber demand for ethanol.

An unusual situation developed this week in the price of isopropyl alcohol. and the Office of Price Stabilization had a hand in it. Carbide and Carbon Chemicals Corp., one of the major producers, reduced the price of its product by 3-4¢ a gallon. The reason: not supply-and-demand, but pricing regulation CPR-22.

It's on File: Carbide and Carbon had previously filed under the manufacturers' regulation CPR-22 to obtain relief from the price squeeze of the OPS general freeze order in January. But CPR-22 must be applied across-the-board. Prices of all company products must be recalculated, with the result that some prices will be lowered while others are raised.

Thus, Carbide reduced isopropyl alcohol and boosted other products, such as acetic acid and diocetyl phthalate. Isopropyl customers now pay 43¢ a gallon delivered for tankcars of 99% grade, 4¢ less than under the preceding schedule. The price decrease in 91% strength for the same quantities comes to 3.5¢. The company now also grants a \$1.75 used drum allowance.

Others Stand: The other major pro-

ducers of isopropyl alcohol show no immediate intention of meeting this price inducement. The others: Shell Chemical Corp. and Esso Standard, which make isopropyl from propylene; and the Celanese Corp. which makes the alcohol by hydrocarbon oxidation.

Major outlet for isopropyl alcohol is acetone, some 75% going to make this versatile ketone. While the acetone market remains firm, as it is now, isopropyl demand will be good, and these other producers will probably be able to maintain the price differential. Acetone finds extensive use in making acetic anhydride, needed for rayon and cellulose acetate plastics.

Other Counts: There are, however, three main factors that may contribute to a weaker isopropyl position later. One possibility is a softening in paint demand, making other ketones available to compete with acetone for solvent uses. Another factor is the demand for rayon, big but fluctuating. Third, is the supply of ethanol, traditional rival of isopropyl alcohol for proprietary and anti-freeze needs.

Trade Outlook: In the long run,

prices of isopropyl alcohol from the several producers will doubtless come together. The present differential will be narrowed faster if a slump occurs in paint or rayon, or if the bounteous supply of ethanol is not preempted by the synthetic rubber program. But while the differential lasts, Carbide customers will enjoy the unexpected dividend.

The Cause: Detergents

Alkyl phenols are experiencing a rising popularity as sales of synthetic detergents and other surface-active agents continue to spurt. Only cloud on the horizon: the phenol shortage.

At present, commercially available compounds include a group of amyl and diethyl phenols produced by Sharples Chemical, para-tertiary butyl from Dow, isopropyl from Koppers, nonyl from Koppers (and soon from Jefferson Chemical), and octyl phenol produced by Rohm and Haas.

Probably the biggest use comes in manufacture of surface-active agents, made by reacting the alkyl phenol with ethylene oxide. By reacting the modified phenol with formaldehyde, a series of oil-soluble resins can be formed which find wide use in the paint and varnish industry.

Alkyl phenols are produced by reacting unsaturated hydrocarbons with phenol in the presence of a catalyst. The supply of the hydrocarbon is no problem, and in most instances, plant capacity isn't either. If more phenol were available, production undoubtedly would increase.

New Capacity: Jefferson is now building a plant for alkyl phenols at Port Neches, Tex., due onstream in April, 1952. Jefferson has already obtained the phenol it needs.

In general, supplies of alkyl phenols have been tight, though a few of the producers report their sales showed slight slumps during the summer months. They look for a fall pickup, with a tighter supply.

Uses for Amyls: Amyls and diethyls go into paint and anti-skidding agents, as intermediates for petroleum demulsifiers, rubber chemicals and agricultural chemicals. Sharples' para-tertiary amyl phenol, sold under the Pentaphen trademark, is used as a bacteriostatic agent.

Isopropyls: Koppers is back in production of isopropyl phenol after a temporary respite. The company reports a rising demand and sees excellent future prospects for an unnamed use in the transportation field. Isopropyl phenol's present price is 46¢ lb. in tanks.

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Diisopropyls are in the offing; the company has not completed its market application work.

Nonyls: Until now, Koppers has been almost alone in production, though Jefferson's new plant will mean more competition. Present price is 33¢ in tanks. In addition to its plans for nonyl, Jefferson is actively checking market applications for the dinonyls.

Rohm and Haas has been considering the production of nonyls, but is held back by lack of phenol. The company makes a limited amount of nonyl, but its low 30 1/2¢ price has not affected the over-all price picture.

Octyl: In addition to the common uses in surface-active agents and oil-soluble resins, octyl phenol finds use as a stabilizer and plasticizer for ethyl cellulose and cellulose acetate. Rohm and Haas feels that its quoted price of 25¢ in tanks puts octyl at a definite competitive advantage.

Developments Coming Up: In addition to those alkyl phenols, Koppers is investigating the production of decyl and Jefferson is checking into dodecyl phenols. But heavy over the head of any such plans hangs the specter of inadequate phenol.

Books

Chemistry of Wood, by Erik Häglund. Academic Press Inc., New York, N.Y.; x+631 pp., \$13.50.

Wood chemistry along with the problems it poses is becoming more and more a significant industrial study reflecting the rise of the importance of wood, and especially pulp, in industrial developments. In emphasizing the fundamental facts—properties and behavior—of wood science, the author discusses the processing of pulp and the reactions involved from a theoretical standpoint. Covered here is the chemistry of cellulose, lignin and accessory constituents in addition to a brief discussion of morphology and physiology. Also treated are processes of wood utilization such as wood saccharification, sulfite, semi-chemical pulping, etc.

Quality-Control Handbook, edited by J. M. Juran. McGraw-Hill Book Co., New York, N.Y.; viii+800, \$10.

Designed primarily for executives, supervisors, and engineers in industry, this volume focuses attention on the principles and practices involved in achieving better quality at lower cost. The handbook is organized so that the first nine sections are devoted to universal principles such as the economics of quality-control, organi-

zation for it, statistical methods, acceptance, etc. along with examples and cases. The last six sections are concerned with the applications of these principles to particular products or processes, such as chemical, textile and aircraft. This book is written as a manual for planning or carrying out a quality-control program.

Textile Laboratory Manual, by Walter Garner. Chemical Publishing Co. Inc., New York, N.Y.; 478 pp. \$8.50.

Textile fibers and the fabrics manufactured from them are featured here. The author covers the physical and chemical properties and other aspects of these fibers and fabrics which include wool, hair, vegetable and filament fibers such as natural silks, synthetics, and glass. Individual sections deal with textile oils, dyes, textile chemicals, detergents, biological, optical and statistical methods. Note is also made of reagents used in textile testing and their standardization.

Selective Toxicity, by Adrien Albert. John Wiley & Sons, Inc., New York, N.Y.; xii+228 pp., \$1.75.

This monograph, one of the series "Methuen's Monographs on Biochemical Subjects," deals with those substances which injure some kinds of cells and not others. Such substances are termed selective toxic agents, such as drugs, weed-killers, and insecticides. The author emphasizes the mode of action—the physical and chemical means—by which toxicants act upon cells; for this knowledge gives an indication of the nature of other selective toxic agents.

MEETINGS

Amer. Oil Chem. Soc., fall meeting Edgewater Beach Hotel, Chicago, Ill. October 8-10.

Natl. Safety Council, congress & exposition, Stevens Hotel, Chicago, Ill., October 8-12.

Electrochemical Soc. Inc., annual meeting, Hotel Statler, Detroit, Mich., October 9-12.

Amer. Tung. Oil Assn., Buena Vista Hotel, Biloxi, Miss., October 11-12.

Boston Conf. on Distribution, Statler Hotel, Boston, Mass., October 15-16.

Amer. Gas Assn., annual convention, Kiel Auditorium, St. Louis, October 15-17.

Amer. Assn. of Textile Chems. & Colorists, annual meeting, Statler Hotel, New York, N.Y., October 17-19.

Inst. of Gas Technol., annual meeting Chicago, Ill., October 18.

Southwide Chem. Conf., Wilson Dam Ala., October 18-20.

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Catalytic Chemicals



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and Metal Soaps



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Optical Crystals



Ceramic Opacifiers
and Colors



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Chemicals



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Commodities



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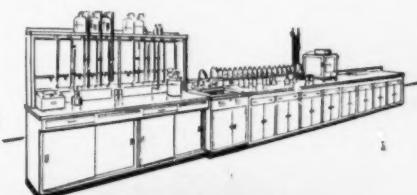
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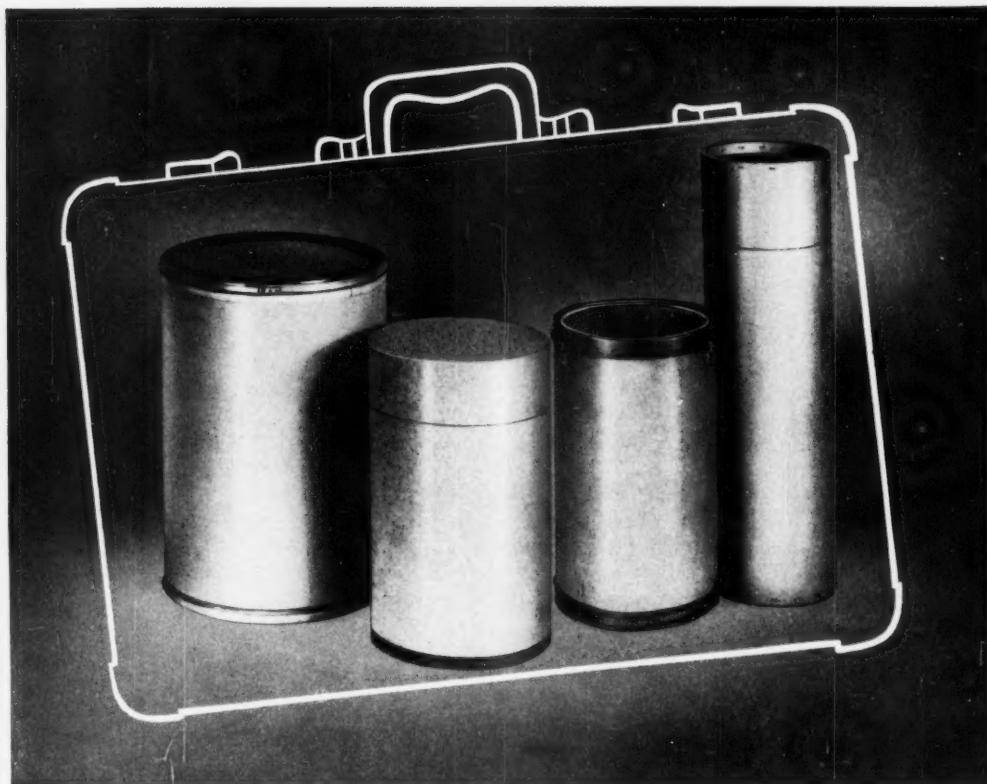
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You can't beat Continental fibre drums for shipping economy. Their light tare weight means worthwhile savings at today's high freight costs — even greater savings on export shipments to countries where import duties are levied on the gross weight.

Continental fibre drums are built to stand up under rough handling. They are rugged and durable, give extra protection to both expensive and dangerous

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• CLEVELAND
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SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS •

OPPORTUNITIES

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UNDISPLAYED RATE:

\$1.20 a line, minimum 3 lines.
To figure advance payment count 5 average words as 4 lines.

POSITION WANTED and Individual Selling Opportunity undisplayed rate is one-half or above rate, payable in advance.

PROPOSALS, \$1.20 a line on insertion.

NEW ADVERTISEMENTS received by 10 A.M. October 4th at the New York Office, 330 W. 42nd St., New York 18, N. Y., will appear in the October 13th issue subject to limitations of space available

INFORMATION

BOX NUMBERS count as one additional line in undisplayed ads.

EQUIPMENT WANTED or FOR SALE Advertisements acceptable only in Displayed Style.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

C. W.

DISPLAYED RATE:

The advertising rate is \$8.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page

SMALL CHEMICAL PLANT

For Sale

(Newark, N. J.)

Agitated Wooden Tanks, Vacuum Filter and Pump, Pumps, Tray Dryer, Large Spray Dryer, Ball Mill.

Root 574 per month with heat

REBATE AGAIN 14500

80 1955 CHEMICAL WEEK

330 W. 42 St., New York City

WANTED

WANTED
SPECTROPHOTOMETER

Beckman Model DU, preferably with the various attachments. Unit must be in perfect operating order. State price desired, location and whether inspection is available.

W 2039 Chemical Week

330 W. 42 St., New York 18, N. Y.

ENGINEER-INDUSTRIAL

Chief Industrial Engineer needed for opening in large company in Philadelphia area. Prefer man with B.S. and M.S. in Industrial Engineering. At least 10 or more years of experience in time study, wage incentives, plant layout, material handling studies, etc. in a supervisory and administrative position. All replies will be confidential. Please send complete resume including education, experience, age and salary desired to . . .

W-81, P. O. Box 3414
Philadelphia 22, Pa.

REPLIES (Box No.): address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 530 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION WANTED

PROCESS and Product Development Engineer—24 years experience in inorganic chemicals with large and small firms. Experienced in research and development, production, plant management, sales. Cost reduction, markets and sources of materials. Age 44, Engineering Education, Salary \$6,000. PW-1924, Chemical Week.

POSITION WANTED

15 YEARS IN Paint, resin, vinyl film, chemicals, seeks position in Sales or Executive Assistant. Age 35. PW-2051, Chemical Week.

AVAILABLE . . .

CUSTOM REFINING FACILITIES

- Distillation
- Extraction
- Separations
- Fractionations
- Drum Lots—Tank Cars

WANTED . . .

- All Types of Crude Mixtures
- By-Products
- Resins
- Wastes
- Contaminated Solvents

TRULAND Chemical & Engineering Co. Inc.

Box 426, Union, N.J. UH-2-7360

AVAILABLE

Spray Drying Units

For Custom Drying or Lease

Call Westfield, N. J. 2-1829

RECLAIMED & SURPLUS

CHEMICALS

Will be found on page 50

"Consolidated"

• BUYS
• SELLS

USED MACHINERY

From a single item to entire plant
for the

CHEMICAL & PROCESS INDUSTRIES

Including Paint, Food, Rubber, Plastics, Sugar, Drugs, Cosmetics and Allied fields.

From a single item to a complete plant.

BUYING? Immediate Delivery

SELLING? Cash Waiting

CONSOLIDATED
PRODUCTS COMPANY, INC.
14-18 Park Row New York 38, N.Y.
BArclay 7-0600

LIQUIDATING

DISTILLERY

Distillation and processing equipment; Grain equipment and storage bins; screw conveyor and bucket elevators; copper tubular condensers; double pipe beer cooler; bronze pumps; copper tanks, steel tanks, etc.

Write for list

PERRY EQUIPMENT CORP.
1415 N. 6th St., PHILA. 22, PA.

GEAR UP FOR
1 BIGGER PRODUCTION
WITHOUT DELAY

GOOD USED
EQUIPMENT

Ready for
immediate shipment

It's impossible to
list in this space
the 5000 machines
available from your
FIRST SOURCE

Send for our
Latest List

FIRST
MACHINERY
CORP.
157 HUDSON ST.
Worth 4-5900
NEW YORK 13, N.Y.

AT YOUR SERVICE

The recognized national medium for the disposal of used or surplus new equipment; for the advertising of positions wanted or vacant; of business opportunities, etc. are the

SEARCHLIGHT SECTIONS of

AMERICAN MACHINIST
AVIATION WEEK
BUS TRANSPORTATION
CHEMICAL ENGINEERING
CHEMICAL WEEK
COAL AGE
CONSTRUCTION METHODS & EQUIPMENT
ELECTRICAL CONSTRUCTION &
MINING
ELECTRICAL MERCHANDISING
ELECTRICAL WORLD
ELECTRONICS
ENGINEERING & MINING JOURNAL
ENGINEERING NEWS-RECORD
FACTORY MANAGEMENT & MAINTENANCE
FLEET OWNER
FOOD ENGINEERING
HYDRAULICS
POWER
PRODUCT ENGINEERING
TEXTILE WORLD
WELDING ENGINEER

for information on rates, etc., write
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McGRAW-HILL
PUBLISHING CO., INC.

330 W. 42nd St., N. Y. 18, N. Y.

MARKET PLACE

LOCAL STOCKS • CHEMICALS
• RAW MATERIALS
EQUIPMENT • SUPPLIES

SAUEREISEN CORROSION-PROOF CEMENTS

Offer complete resistance to both acids and alkalies in steel mills, chemical plants and processing industries. Send blue-prints or sketches, to we may recommend proper cement to use. Write for latest catalog.

THICK ORDER
FOR ACID AND ALKALI USERS
Handy quart cans for making com. \$7.50
parative tests—8 different cements.

Sauereisen Cements Company • Pittsburgh 15, Pa.

RECLAIMED & SURPLUS CHEMICALS

BUY—SELL
TITANIUM DIOXIDE
ZINC OXIDE
LITHOPONE
PHTHALIC ANHYDRIDE
PHENOL
UREA

De Bear 636 ELEVENTH AVE.
INCORPORATED NEW YORK 19, N. Y.

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ETHYLENE GLYCOL
PROPYLENE GLYCOL
METHANOL
TOBEY CHEMICAL CO.
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Tel. Lo 4-2520

BOUGHT — SOLD

Glycols — Cellosolvents — Ethanolamines
Titoniums — Lithopone — Zinc Oxide
Bichromates — Dyes — Colors, etc.
Soda Ash — Caustic Soda
CHEMICAL SERVICE CORPORATION
96-02 Beaver St., New York 5, N.Y.

Triethanolamine

WILLIAM D. NEUBERG CO., INC.
420 Lexington Ave., New York 17, N.Y.
ORegon 9-2550

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RESEARCH AND DEVELOPMENT CORP.
Chemical Research • Processes • Products
Development Problems
Complete Laboratory • Pilot Plant • Mechanical
and Optical Sections
Ask for NEW Scope Sheet C listing over 100 of our activities.
250 East 43rd Street, New York 17, N.Y.

CLARK
MICROANALYTICAL
LABORATORY
CH. N. S. Hal., Alkoxyl, Alkylidene, Acetyl, Terminal
Methyl, etc. Complete and competent service by spe-
cialists in organic micro-chemical analysis.
Howard S. Clark, Director
104½ W. Main St. Urbana, Ill.

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Hormone Assays • Drug Assays
Pharmaceutical and Cosmetic
Research
Sterility Tests • Toxicity Studies
Send for information concerning our services
125 HAWTHORNE ST., ROSELLE PARK, N.J.

COLBURN LABORATORIES, INC.
Research Chemists
• New Product Development
• Organic Synthesis and Research
• Non-routine Analytical Work
723 S. Federal St. Chicago 5, Ill.

R. S. ARIES
AND ASSOCIATES
Chemical Engineers
& Economists
Process Analysis • Surveys —
Technical & Economic • Market
Research • Product Development
• Evaluations • Application
Research
400 Madison Ave., N. Y. 17, N. Y. Eldorado 8-1480

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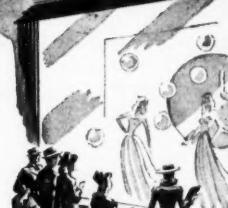
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RESEARCH**
Photoluminescence, Chemical Kinetics, Prop-
agation Rate Studies, Vapor Pressures of Low
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THE ANDERSON PHYSICAL LABORATORY
CHAMPAIGN, ILLINOIS

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Write for "Profit Bulletin"
140 East 38th Street, New York City 18
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F-12A



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IT'S news...

IT'S WORTH
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Maybe Industry doesn't maintain show windows on Fifth Avenue or State Street or Wilshire Boulevard like America's great department stores. But your industry has a mighty effective show window... and this is it... this magazine. In these advertising pages alert manufacturers show their wares. Here you will find up-to-the-minute news about products and services designed to help you do your job better, quicker, and cheaper. To be well-informed about the latest developments in your business, your industry... and to stay well-informed... read all the ads too.

**McGRAW-HILL
PUBLICATIONS**



READER SERVICE

HOW TO USE COUPON

Circle page numbers of items about which you want more details. Then write your name and address on the coupon at the bottom of the page and mail it to us. Your request will be forwarded to companies concerned, the answer coming direct to you.

MAKES IT HANDY

Products and literature in this issue are listed on these pages. There are three indexes. (1) Editorial items on new products, new equipment, new literature; (2) products advertised (3) The index of advertisers is on the following page.

THE NUMBERS

Advertisements:—There is a page number on the coupon for each advertisement. Before the number, may appear, L, R, T, B (left, right, top, bottom), locating the ad on the page. Small letters following (a,b,c) indicate additional products in the advertisement.

Editorial Items:—Numerals are page numbers; the ABC's distinguish among items where more than one is on a page. There is a number on the coupon for each item referring to new products, equipment, and literature.

EDITORIAL ITEMS

For more data, circle number on coupon

NEW EQUIPMENT

Automatic Control	17E
Electric Heating Element	16A
Electronic Relays	17D
Liquid Storage Tanks	17B
Pressure Indicating Control	17C
Vapor Purifier	17A

TECHNICAL LITERATURE

CHEMICALS

Calcium Carbonates, Calcium Oxides	52B
Ion Exchange Materials	52C
Synthetic Organic Chemicals	52A

EQUIPMENT

Compressed Gases, Gas Regulators	52D
Condensate Return Units	52I
Differential Converter	52M
Dry Gas-Holder	52L
Fire Extinguisher	52K
Gas-Analyses	52E
Hydraulic Pump	52H
Nickel and High Nickel Alloy Tubing	52F
Oil Valves	52J
Tank Equipment	52G
Testing Units	52N

PRODUCTS ADVERTISED

For more data, circle number on coupon

Calculators, electronic	3	Reagents	13
Chemicals		Resins, coumarine-indene	T40
Anhydrous calcium chloride	53	Soda ash	1b
Asphaltic products	54F	Stearic acids, oxidation-resistant	41
Bicarbonate of soda	1c	Vinyl stabilizers	54d
Butyl stearate	38	Containers	
Carbon blacks	54a	Drums, fibre	48
Carbonic gas	1d	Shipping sacks, paper	4
Caustic soda	1a	Controls, switch equipped	T14
Diallyl maleate	1b	Laboratory apparatus	
5, 7 Di-iodo 8 hydroxy quinoline	B14a	chemical	47a
Dry ice	1e	Tank cars	18
Ethylene glycol dimethacrylate	1a	Waxes, anti-sinching	54e
Fine	37		
Fused alkali products	If		
Hydro carbon, hard	54g		
Industrial	47b		
Insecticide concentrates	T16		
Metallic stearates	54b		
Organic peroxides	T17		
Oxyquinoline citrate	B14b		
Paint driers	54c		
Pectin	2a		
Peptone	2b		
Perylene	2c		
Phenol red	2d		
Polybutenes, used for Adhesives	42b		
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READER SERVICE COUPON

Mail to Chemical Week, 330 W. 42nd St., N. Y. 18, N. Y.

NAME _____

POSITION _____

COMPANY _____

ADDRESS _____

CITY & STATE _____

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17B	17F	52C	52F	52I	52L	

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1d	1b	2d	13	T16	38	42b				

Expires December 29, 1951

BOOKLETS

Chemicals

Synthetic Organic Chemicals

16-p. booklet, 1952 edition, dealing with the physical properties of synthetic organic chemicals, presents data on more than 300 products, including 38 which have just been added this year. The chemicals are arranged by family group, with the data on physical properties being given in tabular form, plus a short resume on the applications of the products. Carbide and Carbon Chemicals Co.

Calcium Carbonates, Calcium Oxides

Book on calcium carbonates and calcium oxides divided into four parts: natural sugar calcite; imported natural calcium carbonate; precipitated calcium carbonate; and calcium oxide (lime). Each section contains information on the background, source, characteristics, formulations and applications of the material discussed plus more detailed data on the varieties handled by the firm. Whitaker, Clark & Daniels, Inc.

Ion Exchange Materials

15-p. booklet, dealing with the firm's "Nalcite SAR," a strongly basic anion exchanger for the removal of ionic constituents in the water treatment field; it reports on physical properties, exchange capacities, and regeneration techniques. Tables and graphs are included to clarify specific factors and data. National Alumina Corp.

Equipment

Compressed Gases, Gas Regulators

16-p. price-list booklet furnishing in tabular form prices, shipping and handling data, and weights of their line of compressed gases plus additional information and photographs of needle valve controls, automatic regulators, and accessories. The Matheson Co., Inc.

Gas-Analysis

60-p. fourth edition of manual discussing the theory and practical application of gas analysis as well as information concerning setting up apparatus, and procedures involved in the various analyses. The firm's line of unitized gas analysis apparatus is described and illustrated, and instructions on maintaining and operating the equipment are included. Fisher Scientific Co.

Nickel and High Nickel Alloy Tubing

27-p. technical booklet on the fabrication and design of nickel and high nickel alloy tubing, used in chemical and processing industries in the form of pipe lines, condenser and evaporating tubing, and coils for heating and cooling. Various sections are concerned with bursting pressure, welding, brazing, bending and coiling, cast pipe fittings, etc.; three appendices list available forms, tolerances, and specifications. The International Nickel Co., Inc.

Tank Equipment

32-p. bulletin covering series of tank equipment, gas control and safety devices for the safe handling and conservation of combustible or toxic liquids and gases in the petroleum, chemical, marine, food processing, paint and varnish and other industries. The Vapor Recovery Systems Co.

Hydraulic Pump

4-p. bulletin describing high-pressure hydraulic pump applicable to processing foods, pharmaceuticals, corrosive and abrasive materials; advantages and operating characteristics are explained. Scott & Williams, Inc.

Condensate Return Units

General catalog data sheets on vertical condensate return units containing selection table giving EDR sq ft, capacity in gpm, receiver capacity in gallons and range of models according to boiler pressure. This vertical design unit is intended particularly for installation where return piping is close to floor level. Roy E. Roth Co.

Oil Valves

Catalog sheet dealing with design features, applications and operation of electrically operated valves used for safety shut-off of oil flow on all fuel oils, especially the heavy grades, and against oil pressures up to 300 psig. Hauck Mfg. Co.

Fire Extinguisher

Poster designed as fire extinguisher guide for plant employees indicates correct type fire extinguisher to be used on rubbish, wood, flammable liquid, or electrical type fires; all standard type fire extinguishers are illustrated with proper uses explained for each. Randolph Laboratories, Inc.

Dry Gas-Holder

12-p. bulletin reviewing the history, operation and construction of dry seal gas-holder, with synthetic rubber seal, used in the storage of petroleum vapors as well as chemical process and industrial gases at pressures up to 20 inches of water. General American Transportation Corp.

Differential Converter

12-p. illustrated catalog outlining the operating principles, construction features, typical applications, specifications and installation methods of pneumatic-balance type flow transmitter used for the pneumatic transmission of flow or differential pressure measurements. Minneapolis-Honeywell Regulator Co.

Testing Unit

Bulletin describing construction and operation of several models of instruments designed for testing and calibrating current actuated devices. Multi-Amp Corp.

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Dallas 1	James Cash, First National Bank Bldg.
Los Angeles 17	Jos. H. Allen, 1111 Wilshire Blvd.
New York 18	Knox Armstrong, Robert S. Muller, Charles L. Todaro, 330 West 42 St.
Philadelphia 3	William B. Hannum, Jr., Architectural Bldg., 17th & Sansom Sts.
San Francisco 4	Ralph E. Dorland, 68 Post St.
Boston 16	1427 Statler Bldg.
Detroit 26	856 Penobscot Bldg.
Pittsburgh 22	738 Oliver Bldg.
St. Louis 8	3615 Olive St., Continental Bldg.

B & A ANNOUNCES INCREASED PRODUCTION OF ANHYDROUS CALCIUM CHLORIDE

Purified and Reagent Grades

**New Production Process Incorporates Latest Developments in Equipment
and Automatic Control. Assures Consistent Quality, Uniform Particle Size!**

To serve growing needs of chemical, pharmaceutical and food industries, Baker & Adamson has added extensive new production facilities for high purity Anhydrous Calcium Chloride at its B & A Works, Marcus Hook, Pennsylvania. Incorporating the latest developments in automatic control, the new process assures consistent quality and uniform particle size of the product.

As in the past, B & A Anhydrous Calcium Chloride—Reagent and Purified Grades—is available in various sizes ranging from number 20 mesh to $\frac{1}{2}$ " lumps. Each size is carefully

processed to meet exacting production requirements. Like the reagent grade, the purified material is carefully controlled for alkalinity, making it especially adaptable for industrial drying operations. Both grades are porous to provide maximum absorption.

This increased productive capacity will enable Baker & Adamson to meet expanded laboratory and industrial requirements, as well as to maintain adequate stocks at the company's distributing stations throughout the country.

**For information on current delivery
and price schedules, contact nearest
B & A Sales Office listed below:**

Albany	Houston*
Atlanta	Jacksonville
Baltimore*	Los Angeles*
Birmingham*	Minneapolis
Boston	New York*
Bridgeport*	Philadelphia*
Buffalo*	Pittsburgh*
Charlotte*	Providence*
Chicago*	St. Louis*
Cleveland*	San Francisco*
Denver*	Seattle
Detroit*	Yakima (Wash.)

In Wisconsin:
General Chemical Company, Inc.
Milwaukee, Wis.

In Canada:
The Nichols Chemical Company, Limited
Montreal* • Toronto* • Vancouver*

* Full stocks B & A products are carried here

BAKER & ADAMSON Fine Chemicals

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 RECTOR STREET, NEW YORK 6, N. Y.

WITCO PRODUCTS

for

THE CHEMICAL INDUSTRY



check your requirements for:

QUALITY CONTROLLED

CARBON BLACKS
METALLIC STEARATES
PAINT DRIERS
VINYL STABILIZERS
SUNOLITE® (Anti-sunchecking Wax)
ASPHALTIC PRODUCTS
M. R. (Hard Hydrocarbon)

And to assist you in the many problems that today face the chemical manufacturer . . . the shortages of key raw materials . . . the need for new processing techniques . . . the demands of defense orders . . . try

WITCO's TECHNICAL SERVICE

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